

Proposal # <b>2001-</b> <u>F203</u> (Office Use Only)
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**PSP Cover Sheet** (Attach to the front of each proposal)

Proposal Title: TERTIARY & QUATERNARY WASTEWATER TREATMENT FOR WATER QUALITY  
 Applicant Name: UNIVERSITY OF CALIFORNIA, BERKELEY RESTORATION WITHIN THE BAY.  
 Contact Name: Pat Gates DELIA.  
 Mailing Address: Sponsored Projects Office, 336 Sproul Hall, Berkeley, CA 94720-3940  
 Telephone: 510-642-8109  
 Fax: 510-642-8236  
 Email: pgates@uclink.berkeley.edu

**Amount of funding requested:** \$ \$1,635,571 (State) or \$2,173,042 (Federal)

Some entities charge different costs dependent on the source of the funds. If it is different for state or federal funds list below.

State cost \$1,635,571

Federal cost \$2,173,042

**Cost share partners?**

☒ Yes ☐ No

Identify partners and amount contributed by each Professor William J. Oswald Ph.D. P.E.  
in-kind services of \$41,000 per year for 3 years Professor Mary K. Firestone  
Ph.D. will contribute \$ 7,000 over 3 years.

**Indicate the Topic for which you are applying (check only one box).**

- |  |  |
|--|--|
| <input type="checkbox"/> Natural Flow Regimes                | <input type="checkbox"/> Beyond the Riparian Corridor                |
| <input type="checkbox"/> Nonnative Invasive Species          | <input type="checkbox"/> Local Watershed Stewardship                 |
| <input type="checkbox"/> Channel Dynamics/Sediment Transport | <input type="checkbox"/> Environmental Education                     |
| <input type="checkbox"/> Flood Management                    | <input type="checkbox"/> Special Status Species Surveys and Studies  |
| <input type="checkbox"/> Shallow Water Tidal/ Marsh Habitat  | <input type="checkbox"/> Fishery Monitoring, Assessment and Research |
| <input type="checkbox"/> contaminants                        | <input type="checkbox"/> Fish Screens                                |

What county or counties is the project located in? Contra Costa, San Joaquin, Merced, Napa

What **CALFED** ecozone is the project located in? See attached list and indicate number. Be as specific as possible Ecozones 2, 11

Indicate the type of applicant (check only one box):

- |  |   |
|--|---|
| <input type="checkbox"/> State agency                    | <input type="checkbox"/> Federal agency |
| <input type="checkbox"/> Public/Non-profit joint venture | <input type="checkbox"/> Non-profit     |
| <input type="checkbox"/> Local government/district       | <input type="checkbox"/> Tribes         |
| <input checked="" type="checkbox"/> University           | <input type="checkbox"/> Private party  |
| <input type="checkbox"/> Other: _____                    |   |

**Indicate the primary species which the proposal addresses (check all that apply):**

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> San Joaquin and East-side Delta tributaries <del>fall-run</del> chinook salmon | <input type="checkbox"/> Spring-run chinook salmon           |
| <input type="checkbox"/> Winter-run chinook salmon   | <input type="checkbox"/> <del>Fall-run</del> chinook salmon  |
| <input checked="" type="checkbox"/> Late-fall run chinook salmon   | <input type="checkbox"/> Longfin smelt                       |
| <input type="checkbox"/> Delta smelt   | <input type="checkbox"/> <del>Steelhead</del> trout          |
| <input type="checkbox"/> Splittail   | <input type="checkbox"/> Striped bass                        |
| <input type="checkbox"/> Green sturgeon  | <input type="checkbox"/> All chinook species                 |
| <input type="checkbox"/> White Sturgeon  | <input checked="" type="checkbox"/> All anadromous salmonids |
| <input type="checkbox"/> Waterfowl and Shorebirds  | <input type="checkbox"/> American shad                       |
| <input type="checkbox"/> Migratory birds   |  |
| <input type="checkbox"/> Other listed T/E species: _____   |  |

**Indicate the type of project (check only one box):**

- |  |   |
|--|---|
| <input type="checkbox"/> Research/Monitoring           | <input type="checkbox"/> Watershed Planning |
| <input checked="" type="checkbox"/> Pilot/Demo Project | <input type="checkbox"/> Education          |
| <input type="checkbox"/> Full-scale Implementation     |   |

Is ~~this~~ a next-phase of an ongoing project? Yes \_\_\_\_\_ No x

Have you received funding from CALFED before? Yes x No \_\_\_\_\_

If yes, list project title and CALFED number Irrigation Drainage Water Treatment for  
~~\_\_\_\_\_ and Removal of Pesticides~~ San Joaquin Drainage District

Have you received funding from CVPIA before? Yes \_\_\_\_\_ No x

If yes, list CVPIA program providing funding, project title and CVPIA number (if applicable):

By signing below, the applicant declares the following:

- The truthfulness of all representations in their proposal;
- The individual signing the form is entitled to submit the application on behalf of the applicant (if the applicant is an entity or organization); and
- The person submitting the application has read and understood the conflict of interest and confidentiality discussion in the PSP (Section 2.4) and waives any and all rights to privacy and confidentiality of the proposal on behalf of the applicant, to the extent as provided in the Section.

**THE REGENTS OF THE UNIVERSITY OF CALIFORNIA**

Printed name of applicant

*David Aaron*

Signature of applicant

For Patricia A. Gates  
Sr. Research Administrator

6/2/00

UNIVERSITY OF CALIFORNIA, BERKELEY

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BERKELEY ■ DAVIS ■ IRVINE ■ LOS ANGELES ■ RIVERSIDE ■ SAN DIEGO ■ SAN FRANCISCO

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SANTA BARBARA ■ SANTA CRUZ

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ENVIRONMENTAL ENGINEERING & HEALTH SCIENCES LABORATORY  
412 O'BRIEN HALL

BERKELEY, CALIFORNIA 94720-1766

June 1, 2000

CVPIA and CALFED

I am pleased to offer the following proposal on Tertiary and Quarternary Wastewater Treatment for funding consideration by CVPIA and CALFED. Professor Emeritus Oswald is a distinguished researcher at UC Berkeley and maintains an active research group. Due to a shortage of space on campus and at the University's Richmond Field Station, this proposal is being submitted with the understanding that this research group will have access to staff office space and wet chemical laboratory space only through September 30, 2001. After that date the Environmental Engineering and Health Sciences Laboratory will provide an office for Professor Oswald and permit his research group to have access to the outdoor pilot plant facilities.

Please feel free to contact me if you need any additional information. Thank you for your favorable consideration.

Sincerely,

A handwritten signature in cursive script that reads "James R. Hunt".

James R. Hunt  
Professor of Civil and Environmental Engineering  
Director of the Environmental Engineering and Health Sciences Laboratory



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**

**REGION IX LABORATORY  
1337 S. 46TH STREET  
BLDG. 201  
RICHMOND, CA 94804-4698**

May 31, 2000

Professor William J. Oswald, Ph.D., P.E.  
Environmental Engineering and Health Sciences Laboratory (EEHSL)  
Richmond Field Station  
University of California, Berkeley  
1301 South 46<sup>th</sup> Street, Building 112  
Richmond, CA 94804

Dear Professor Oswald

The U.S. EPA Region 9 Laboratory was constructed at the Richmond Field Station in part to foster collaboration and cooperation between the Region 9 Laboratory personnel and University researchers. The on-going relationship that has been established between your Applied Algae Research Laboratory at EEHSL and the Region 9 Laboratory during the past four years has been among the best examples of cooperative effort. The EPA studies of the wastewater treatment facilities at St. Helena and Delhi, California were greatly facilitated by the participation of your researchers from the Applied Algae Research Laboratory, and the use of some Region 9 Laboratory equipment has no doubt benefitted your research.

The purpose of this letter is to invite the Applied Algae Research Laboratory to work with the EPA to finalize the draft Memorandum of Understanding (MOU) that will expand the cooperation between our two laboratories. The MOU will likely allow the use of laboratory space at the Region 9 Laboratory and the sharing of certain laboratory and field equipment by personnel at the Applied Algae Research Laboratory at EEHSL and EPA. Opportunity for exchange of information and joint participation in additional field studies and laboratory activities will be pursued.

I look forward to interaction with you while you continue to conduct research on nitrate and selenium removal under your current contract with the CALFED Bay-Delta Program, of which the U.S. EPA is a partner agency, and during future CALFED or Central Valley Project Improvement Act projects.

Sincerely,


A handwritten signature in cursive script that reads "Brenda Bettencourt".

Brenda Bettencourt  
Region 9 Laboratory Director

BERKELEY Ecosystem Sciences Division  
Department of Environmental Science,  
Policy, and Management  
mldston@natnreberkeley.edu

**June 1,2000**

To: Professor William J. Oswald  
Environmental Engineering and Health Sciences Laboratory

From: Mary Firestone   
Division of Ecosystem Sciences  
Departmental of Environmental Science, Policy, and Management

**Re: Central Valley Project Improvement Act research proposal**

During the course of the proposed project entitles 'Tertiary and Quaternary Wastewater Treatment for Water Quality Restoration with the Bay-Delta', I will contribute a portion of my time to studies on heterotrophic nitrification-denitrification in the Advanced Integrated Wastewater Pond system at the Richmond Field Station. The three-year project is expected to begin in October 2001. I will contribute 3% of my time in the first year and 2% in each of the following two years. My salary will be covered by the California Agricultural Experiment Station as a contribution in-kind.

# Tertiary and Quaternary Wastewater Treatment for Water Quality Restoration within the Bay-Delta

University of California, Berkeley

## EXECUTIVE SUMMARY

Nitrogen in municipal wastewater discharges and in runoff from farms and confined animal facilities has become a serious problem within the Bay-Delta ecosystem and specifically at Stockton and upstream along the San Joaquin River and other rivers where ammonia levels and eutrophication adversely impact anadromous fish. Current methods of removing fixed nitrogen from wastewater are expensive to build, energy intensive, and complex to operate; they are often accompanied by other adverse impacts on the environment. We accordingly propose to operate, optimize, and demonstrate a unique wastewater treatment process that more efficiently removes all forms of nitrogen and many trace toxic compounds. This pond-based treatment process, developed over the last ten years, is significantly less expensive to build and to operate; it is also less energy intensive and complex to operate; and it offers many environmental benefits over the conventional methods of tertiary (nutrient removal) and quaternary (trace toxics removal) wastewater treatment. The primary research will take place at the University of California at Berkeley's Environmental Engineering and Health Sciences Laboratory (EEHSL) at the Richmond Field Station. There a demonstration-scale ( $110\text{-m}^3$  per day) wastewater treatment facility receiving municipal sewage will allow operational research, demonstration, and the acquisition of performance and environmental data. Water quality analyses, optimization research, and engineering evaluation will be conducted by personnel at EEHSL; the U.C. Berkeley Department of Environmental Science, Policy and Management; and Lawrence Berkeley National Laboratory. Field studies will also be conducted using two  $1,000\text{-m}^2$  High Rate Ponds that will be constructed at the City of Stockton's Regional Wastewater Control Facilities. The study results will be of immediate importance to the City of Stockton and Regional Water Quality Control Board as the Board sets new discharge limits for Stockton, and the City evaluates treatment technologies for the upgrade of their Regional Wastewater Control Facility. Although both the Richmond and Stockton research systems will be operated using municipal wastewater, this advanced, yet low-cost, wastewater treatment process, and the results of this investigation, would be applicable to the management of other wastewaters contaminated with nitrogen and trace toxics.

## 1.0. STATEMENT OF THE PROBLEM

Nitrogen contamination of rivers and groundwater basins is a major environmental and public health concern in the San Joaquin Valley. The deleterious effects of nitrogen such as ammonia toxicity and eutrophication are worsened by water diversions, limited water supplies, and consequential lower flows in the San Joaquin River. Furthermore, high nitrate concentrations found in groundwater threaten potable water supplies. Since 1980, over 200 municipal wells in the Central Valley Region have been closed due to excessive nitrate concentrations. Increasing population is expected to accelerate the demand upon these groundwater supplies (RWQCB/CVR, 1998).

Wastewater — whether sewage, agricultural, or agro-industrial — is a major path for nitrogen contamination of water resources and the environment. Therefore, wastewater treatment technology that can more completely treat and reclaim wastewater and the nitrogen it contains could be an important component in solving the problems associated with diminishing water quality and supply.

Conventional methods of tertiary treatment and wastewater reclamation that would permit its safe reuse are expensive in terms of capital and operation, energy use, and adverse environmental impacts including the emission of greenhouse gases and other air pollutants. The activated sludge process has been readily accepted due to its effectiveness in removing gross pollutants as indicated by biochemical oxygen demand (BOD) and total suspended solids (TSS) over a short hydraulic residence time. Unfortunately, as more nutrients and trace toxic pollutants are added to the list of regulated substances, the short residence time and relatively uniform aerobic conditions that predominate within the activated sludge process may limit overall treatment effectiveness. Wastewater treatment technology that combines longer hydraulic residence times, complex microbial communities, and diverse chemical environments (redox and pH) has been developed at the University of California, Berkeley.

Control of nitrogen and trace toxics, such as arsenic, copper, lead, mercury, is an immediate concern for the CVPIA Program, the CALFED Bay-Delta Program, the City of Stockton, other municipal dischargers, as well as food processing plants and farms within Bay-Delta watershed. The high cost of implementing most of the proposed conventional upgrades and expansions of Stockton's Regional Wastewater Control Facilities (RWCF), inadequate on-site proof of alternative treatment options, and regulatory uncertainties have delayed implementation of the proposed improvements and expansions. Therefore, the City of Stockton's RWCF with its 630 acres of 1940-era conventional oxidation ponds are an ideal focal point for research and demonstration of an alternative tertiary and quaternary treatment technology that would efficiently utilize the existing treatment facilities and the large area devoted to ponds.

### *Stockton's Water Quality Challenges*

Fish migration and the health of fish and other wildlife within the San Joaquin River near Stockton are threatened by low dissolved oxygen concentrations and potentially by ammonia and trace toxics discharged from the Stockton RWCF. For example, in 1999 total ammonia nitrogen concentration ( $\text{NH}_3 + \text{NH}_4^+$ ) in the effluent discharged from the RWCF into the San Joaquin River was as high as 21 mg/L as N during the period from August 1 through October 31 when the proposed effluent permit requirements may be set as low as 2 mg/L as N (Figure 1). For the current NPDES permit renewal, the Regional Water Quality Control Board has considered requiring nitrification and denitrification in order to reduce algal growth in the River (RWQCB, 1999). Meeting potential Water Quality-Based Effluent Limits for eight metals and 51 organics listed in the new California Toxics Rule is another major concern for the City of Stockton. Although the Stockton RWCF

effluent has low concentrations of trace toxics, mass limits of trace toxics may be imposed as part of the NPDES permit renewal. Finally, pathogen removal may need to be improved at the Stockton RWCF. The California Department of Health Services has recommended that the Stockton RWCF employ year around filtration and enhanced disinfection to achieve a total coliform level of less than 2.2 MPN per 100 mL and a turbidity of less than 2 NTU. Study of effluent virus concentrations under worse-case scenarios was also recommended (DHS, 1999). If this year's permit reauthorization includes ammonia removal, the City of Stockton may have to immediately begin detailed planning and engineering design to retrofit and expand the RWCF to a capacity of 48-MGD. Using conventional biotower and nitrifying secondary activated sludge, this expansion has an estimated capital cost of between \$87 million and \$122 million (Parsons/Carollo, 1999). Retrofitting the Stockton RWCF and the 680 acres of conventional oxidation ponds using the Advanced Integrated Wastewater Pond Systems (AIWPS<sup>®</sup>) Technology, that now includes tertiary and quaternary treatment processes that were developed at the University of California at Berkeley over the past 12 years, was estimated to cost between \$35M and \$40M, even for significantly larger expanded capacity of up to 85 MGD (Oswald and Green, 1994). AIWPS<sup>®</sup> Facilities, in addition to their lower capital and operating costs and simplicity of operation, offer high levels of nitrogen removal as has been shown at the AIWPS<sup>®</sup> Demonstration Facility at the University of California, Berkeley Richmond Field Station (Figure 3 and 4). Treatment to Title 22 unrestricted reuse quality (Figures 5 and 6), natural virus inactivation (Figure 7), and metals removal (Tables 2 and 3) also have been demonstrated at the AIWPS<sup>®</sup> Facilities.

### ***AIWPS<sup>®</sup> Technology Described***

The AIWPS<sup>®</sup> Technology consists of a series of ponds uniquely designed to promote multiple wastewater treatment processes by a diversity of physical, chemical, and biological mechanisms. For nitrogen removal, four major mechanisms are employed: heterotrophic nitrification-denitrification of organic nitrogen within the intensely anaerobic environment of fermentation zones or "In-pond Digesters" of primary Advanced Facultative Ponds (AFP); direct ammonium-nitrogen assimilation during growth of microalgae in High Rate Ponds (HRPs); ammonia volatilization during high pH conditions created by algal growth in the HRPs, and final removal of assimilated organic nitrogen in the form of algal solids using Dissolved Air Flotation (DAF) (Figure 8). The AIWPS<sup>®</sup> Technology also passes the wastewater through a series of environments that provide metals removal. The low redox potential in the In-pond Digesters promotes sulfide-metal precipitation; algae in the AFPs and HRPs provide metal sorption sites; the high pH of the HRPs favors formation of metal-hydroxides and precipitation or coprecipitation of some metals; and, coagulation and filtration during algae harvest provides another opportunity for metals removal. An important aspect of the proposed work is to determine the extent to which each of these mechanisms function to promote metals removal in the AFP in order to protect the reuse value of the harvested HRP algae.

The AIWPS<sup>®</sup> Technology minimizes the use of electro-mechanical equipment, requires less energy, and has lower operating costs as compared with conventional wastewater treatment processes such as activated sludge followed by tertiary denitrification. AIWPS<sup>®</sup> Facilities require between 10% and 50% of the energy used in secondary activated sludge facilities (Green *et al.*, 1996). Energy can be produced from methane collected by submerged canopies over the In-pond Digesters (Green *et al.*, 1995). AIWPS<sup>®</sup> Facilities that include algal HRPs have been implemented at several municipalities within California including St. Helena, commissioned in 1967; Hollister, commissioned in 1978; and Delhi, commissioned in 1998. Each of these AIWPS<sup>®</sup> Facilities were designed for



secondary treatment and do not include complete removal of algal solids for final tertiary treatment. At the Richmond AIWPS Facility, complete tertiary treatment for advanced wastewater reclamation according to Title 22 unrestricted reuse requirements has been demonstrated recently as part of a salt increment removal study using reverse osmosis (Downing *et al.*, 1999; Nurdogan and Oswald, 1995; Nurdogan, 1988) (Figures 4-6). The proposed project will advance the state of the art by allowing continuous research over three years and in all seasons. It is expected that techniques will be developed that will improve tertiary and quaternary treatment performance and reliability using the AIWPS Technology. The project will also provide additional performance data needed to verify process reliability for the City of Stockton and other municipal dischargers to the San Joaquin River.

As much as half of the sewage nitrogen is reduced to nitrogen gas ( $N_2$ ) in the fermentation zones within the Advanced Facultative Ponds with no energy expenditure at all. Nitrogen-rich algae harvested by DAF can be dried, stored, and used as a slow-release fertilizer replacing more mobile commercial fertilizers such as urea or combined with low-nitrogen forest products to enhance their value as a plant fertilizer and soil amendment.

Heterotrophic nitrification followed by denitrification is a poorly understood yet effective nitrogen removal mechanism. First revealed in studies of overloaded oxidation ponds in the 1960s (Bronson, 1963), the process has since been studied by microbiologists and soil scientists (Pedersen, Dunkin & Firestone, 1999; Schimel, Firestone, & Killham, 1984; Laurent, 1971; Verstraete and Bergerova, 1973; Tate, 1975; Focht and Verstraete, 1977; Witzel and Overbeck, 1979). Location studies by Bronson (1963) and by Green (1998) indicate the sole origin of  $N_2$  is organic nitrogen undergoing intensive fermentation within the sludge blanket. They also have reported that the greatest  $N_2$  emissions accompany the greatest methane fermentation rates. Biogas collected from the two In-Pond Digesters of the Richmond AIWPS Facility has been approximately 23% nitrogen (Figure 9). Few, if any, wastewater treatment technologies purposefully promote the HN pathway at this time.

## 1.1. CONCEPTUAL MODEL

Wastewater treatment both protects and threatens the environment. The aquatic environment is benefitted by treatment but with severe penalties from energy consumption, greenhouse emissions, and sludge disposal. Each kWh of electrical energy generated from fossil fuel is accompanied by the release to the atmosphere of nearly 1 kg of carbon dioxide (MIT, 1998). Accordingly, in conventional nitrification followed by denitrification processes, the removal of the organic nitrogen contained in the waste of one population equivalent is accompanied by the release of approximately 230 grams of  $CO_2$  to the atmosphere due to power generation alone. In addition, approximately 90 grams of  $CO_2$  are released to the air from aerobic bacteria oxidizing sewage in aeration basins. Conventional treatment also has economic and social penalties, especially in small communities, since mechanical wastewater treatment projects usually mean substantial public funds are exported from the community.

As the Central Valley population increases and existing municipalities require upgraded and expanded wastewater treatment facilities, nitrogen cycling will be affected by the treatment technologies adopted. The overarching model guiding the proposed project is a "nutrient shed" model of the San Joaquin Valley. Nutrient shed analysis was proposed by Oswald in order to bring to light the dead-ends in human-mediated nutrient cycling that result in ecosystem degradation (Oswald and Golueke, 1966). Similar mass-balance models were published in the same period (Odum, 1965) and are now widely used. Analysis of potential water reclamation and reuse is the

obvious "watershed" complement to the nitrogen cycling analyses.

In the process of treating wastewater to a tertiary level, the AIWPS' Technology can reclaim not only water but much of the total nitrogen (Oswald *et al.*, 1994). Most of the recovered nitrogen will be in the form of algal biomass that is expected to be clean enough to meet the criteria of a Class A Biosolid and to allow its use as a crop fertilizer. This recovered nitrogen can partially offset the importation and use of chemical fertilizers.

In the proposed project, the results of the AIWPS' Technology demonstration will be analyzed in the context of the aquatic nutrient shed of the San Joaquin Valley. Extrapolation of the results will indicate to what extent water quality could be improved from widespread adoption of this alternative wastewater technology in the San Joaquin Valley. A similar analysis of conventional tertiary treatment via nitrification will be conducted for comparison.

The targeted research and demonstration tasks are described in Section 2.2 Approach. The uncertainties are the ability of AIWPS' Facilities to consistently remove ammonia-nitrogen to  $<2$  mg/L, the consistency and extent of metals removal, and the associated capital and operational costs. Few data are available on the rates of nitrogen removal via heterotrophic nitrification-denitrification.

## **1.2. OBJECTIVES AND HYPOTHESES**

The objective of this project is to demonstrate that the water supply for wildlife and agriculture can be increased and improved through reclamation of wastewater in low-cost, advanced integrated ponding systems. The hypotheses are as follows:

- 1) AIWPS' Facility effluents will be of higher quality than those of the more costly, conventional mechanical *or* conventional pond systems. The effluent will meet new proposed limits for nitrogen and metals for municipal discharges to the San Joaquin River;
- 2) AIWPS' Facilities can reliably reclaim municipal wastewater for safe irrigation reuse at lower capital and operating costs than can conventional wastewater treatment technologies; and,
- 3) Algal biomass harvested from several AIWPS' facilities in California will have low levels of heavy metal contamination and with natural or chemical disinfection will be a safe and effective fertilizer.

## **1.3. ADAPTIVE MANAGEMENT PLAN**

Demonstration and optimization of the AIWPS' Technology over several years at  $110\text{m}^3/\text{day}$  is the appropriate scale for the project given the success of past short-term pilot studies. The proposed project will develop cost, performance, and engineering design data necessary for full-scale implementation at the City of Stockton and other municipalities located along the San Joaquin River.

The proposed studies will test and attempt to improve the maximum hydraulic and pollutant loading rates that the AIWPS' Technology can process, while meeting the nitrogen, pathogen, and heavy metal objectives for the Stockton RWCF. Piloting of treatment technologies by its nature requires frequent assessment of results and redirection of effort. Some major conceivable adaptations of the research plan are outlined below.

- If conventional sand filters do not reliably produce a final effluent with  $<2$  NTU, then a microfilter could be leased and tested earlier than scheduled.

- If metal concentrations in harvested algae are approaching levels that might restrict their beneficial use, the residence time in the In-pond Digesters could be increased to enhance sulfide-metal precipitation.
- If it is determined that overall solar isolation is more limiting to algal growth during winter than is algal turbidity, the depths and residence times in the High Rate Ponds may be increased.

#### **1.4. EDUCATIONAL OBJECTIVES**

Technology transfer to municipalities, agriculture, and industries will be another prime objective of the project. Dozens of Central Valley communities are awaiting funds from the State Revolving Fund Loan Program for treatment facility upgrades and expansions. Selected communities (e.g., Modesto, Gustine) and agricultural and industrial organizations (e.g., Western United Dairymen, Tri-Valley Growers) will be kept apprised of the results of the proposed project through a semi-annual newsletter and follow-up meetings, as requested. The Richmond AIWPS Facility has been a successful technology transfer site for visiting scientists, concerned citizens, and agency representatives. In the last 10 years, the Facility at EEHSL has been visited by hundreds of scientists, engineers, regulators, academics, and interested citizens from all over the world.

#### **2.0. PROPOSED SCOPE OF WORK**

The proposed study is to take place in the Advanced Integrated Wastewater Pond System (AIWPS®) Demonstration Facility of the Environmental Engineering and Health Sciences Laboratory at the University of California at Berkeley Richmond Field Station. A 110-m<sup>3</sup>/day system with an estimated capital value of \$200,000 is already in place. It currently consists of an influent control and flow metering headworks, an Advanced Facultative Pond with two In-pond Digesters, two High Rate Ponds, Algae Settling Ponds for preliminary algal removal, and a permitted final discharge to the City of Richmond's municipal wastewater treatment plant. A continuous flow of raw sewage from a typical bedroom community is provided to the Facility via a dedicated pumping station on a main sewer. In the treatment process, raw, coarsely-screened, sewage is metered into isolated, intensely anoxic, zones within the Advanced Facultative Pond whence it overflows into a paddle wheel-mixed High Rate Pond where algal growth provides photosynthetic oxygenation. The resultant green, oxygen-rich water then is passed through the Algae Settling Pond. In the proposed project, the High Rate Ponds will be operated in series in conjunction with dissolved air flotation, sand filtration, and UV disinfection. Effluent from the DAF flows to a second High Rate Pond for final algal growth and thence to a final slow sand filter. Other modes of operation may be installed and investigated as indicated by findings during the study. The objective is to determine the operational regimes which provide the most complete total nitrogen removal at minimum cost and minimal environmental impact.

#### **2.1. LOCATION OF PROJECT**

The existing AIWPS Demonstration Facility is located in Richmond, Contra Costa County within the Bay-Delta Watershed and Ecological Zone 2 (Suisun March/San Francisco Bay Zone; 37° 56' N, 122° 21' W). New pilot facilities will be located at the Stockton RWCF, San Joaquin County, Ecological Zone 11 (Eastside Delta Tributaries Zone; 37° 54' N, 121° 15' W). The results of the project will be applicable in much of the Bay-Delta Watershed.

## 2.2. APPROACH

The project will consist of pilot testing of the AIWPS' Demonstration Facility at the University of California at Berkeley's Richmond Field Station after modification with new equipment and a new operational sequence. The piloting will attempt to meet potential regulatory limits facing the Stockton RWCF for nutrients, pathogens, and metals. After proof of concept and troubleshooting at Richmond, pilot High Rate Ponds will be built at Stockton and their nutrient removal performance compared to that of the Richmond AIWPS® Facility. Location of a complete pilot AIWPS'' Facility at Stockton should not be required to accomplish the demonstration. At Richmond, the AIWPS' Facility, research infrastructure, and research staff are already in place, and rapid progress can be made there. The existing Advanced Facultative Pond (AFP) at Richmond has been operated continuously since 1995, and a mature microbial consortia is present in the In-Pond Digesters (IPDs). The AFP and its two IPDs will be the focus of our research on the heterotrophic nitrification-denitrification process. The research described below is extensive, covers several topics simultaneously, and requires the resources of three UC Berkeley laboratory groups. This collaborative and intensive research approach will take full advantage of the operation of the pilot facilities as opposed to single topic research.

**Task 1.** Update the 110-m<sup>3</sup>/day AIWPS'' Demonstration Facility at Richmond to the state-of-the-art by providing new components and equipment. Operate the Facility under a pre-planned regime.

- Design, fabricate, and install 100-m<sup>2</sup> submerged gas canopy over one IPD; install new gas meters.
- Install a 160-m<sup>3</sup>/day Krofta Tech Supracell' DAF clarifier following each High Rate Pond.
- Install a final effluent filter (both sand and microfilter will be tested) and a UV disinfection system.
- Install a carbonation sump in each of the two High Rate Ponds.
- Provide operation, experimental control, and maintenance of the Richmond AIWPS'' Facility.

**Task 2.** Construct and operate two pilot High Rate Ponds at the Stockton RWCF.

- Ammonia removal kinetics of HRP's will be compared to those of the Richmond AIWPS® Facility and other full-scale HRP's during summer, winter, and canning season conditions.

**Task 3.** Investigate nitrogen and carbon removal performance and mechanisms; monitor salt concentration.

- Collect data needed to determine mass balances and to follow the transformations of the following components:
  - Water flow;
  - Nitrogen (ammonia, nitrate, nitrite, organic nitrogen, nitrogen gas);
  - Carbon (methane, dissolved inorganic carbon, organic carbon, carbon dioxide);
  - Oxygen (dissolved oxygen, total and soluble BOD); and,
  - Suspended solids (total and volatile).

Routine water and gas samples will be collected weekly, gases will be continuously metered.

- Monitor salts in the influent and final effluent (TDS and sodium adsorption ratio).

Mass balances will be performed for each element of the Facility (IPDs, AFP, HRP's, DAF's, final filter(s), UV disinfection unit) including gas evolution and sludge accumulation. Submerged canopies completely covering the two IPDs will be used for methane collection (a potential energy source) and for measurement of nitrogen evolution. Nitrogen removal by heterotrophic nitrification/denitrification

will be investigated by Professor Firestone's laboratory using  $^{15}\text{N}$  tracer or isotope-dilution studies and analytical equipment for low-level  $\text{NO}_x$  gas measurement. During Year 1, the rates of heterotrophic nitrification-denitrification of the IPD culture will be determined in the laboratory for summer and winter temperatures. During Year 2 and Year 3, changes in the IPD inlet configuration and hydraulic loading rate will be evaluated for nitrogen removal based on the mass of dinitrogen ( $\text{N}_2$ ) collected by the submerged collectors. If the changes to the IPD increase  $\text{N}_2$  evolution, additional determination of the heterotrophic nitrification-denitrification rates of the IPD culture will be made. This approach should reveal whether the configuration changes increased the density of organisms capable of heterotrophic nitrification or if the increased  $\text{N}_2$  evolution was due to better contact between the organisms and the wastewater.

**Task 4.** Optimize treatment process for pathogen removal and to achieve reuse-quality effluent.

- Determine DAF and filter operational parameters for optimized turbidity removal prior to disinfection (test coagulant combinations, filter loading and backwash rates, compare treatment and fouling in sand filters and microfilters)
- Determine dose-response for UV disinfection of filtered and unfiltered effluents; monitor lamp fouling rates
- Monitor MS bacteriophage indicator virus, total coliform, and *E. coli* in each element of the Facility

**Task 5.** Determine reuse value of waste-grown algal biomass

- Monitor contaminants in harvested algae (total coliform, *E. coli*, Salmonella, and metals)
- Develop a disinfection strategy for the biomass such as storage, composting, or ozonation
- Monitor the nutrient content and form in the harvested algae (ammonia, organic nitrogen, total and soluble phosphorus, potassium).
- Compare nutrient leaching from  $1\text{-m}^2$  planted containers fertilized with chemical fertilizer, manure, and algal biomass.

**Task 6.** Determine metals removal performance and partitioning

- Monitor total and dissolved metals in the influent and effluent of each element. The metals to be determined are mercury (monthly) and lead, copper, zinc, silver, nickel, & cadmium (twice-monthly).
- Measure metals concentrations in primary sludges and algal biomass
- Monitor parameters that influence metals removal within each element of the Facility (redox potentials, pH, sulfate/sulfide concentrations)

Metal analyses will be conducted by the Environmental Measurement Laboratory, Earth Sciences Division, Lawrence Berkeley National Laboratory, an EPA/California Department of Health Services certified analytical laboratory.

**Task 7.** Project management, data analysis, engineering analysis, report preparation, and technology transfer

- Coordinate project research groups, maintain experimental schedule, adapt experimental plan in order to improve the performance of the Facility and to maximize value of results for the Stockton RWCF and other communities with wastewater treatment pond facilities.
- Prepare semi-annual reports that present project activities and
  - the rates and extent of removal of nitrogen, metals, pathogens, and other pollutants

- annually updated engineering and cost analyses of the AIWPS® Technology as it might be applied at Stockton for nutrient removal and/or reclamation for reuse
- Prepare a semi-annual newsletter describing project results and their potential applications in new wastewater treatment facilities or upgrades. Distribute the newsletter to interested local governments and to industry and agriculture groups. Post the newsletters and other information on the project website.

### **2.3. MONITORING AND ASSESSMENT PLAN**

The monitoring of water and biomass quality is outlined above in Section 2.2, Approach. The results will be assessed in scientific and engineering terms. The information collected on heterotrophic nitrification, the fate of nitrogen in the High Rate Ponds, and the performance of the innovative application of UV disinfection will be analyzed to understand the mechanisms of the processes. Engineering information on Facility performance and optimal loading rates will be compared to data obtained from the full-scale secondary Delhi and St. Helena AIWPS® Facilities

### **2.4. DATA HANDLING AND STORAGE**

The data collected from the demonstration and pilot systems will cover water quality, flows, operational and environmental conditions. Depending on the parameter, these data will be collected at time intervals of daily to weekly. The spreadsheet databases will have daily time intervals. This will allow easy coordination of all parameters for calculating mass balances and investigating the influences of operations and environmental conditions. Data will be analyzed in terms of mass pollutant removals, concentration averages, and effluent concentration probabilities. Laboratory quality control results will be entered in the same spreadsheets as the sample data, allowing convenient confirmation of the reliability of the laboratory analyses. Multi-variate statistics may be used to analyze seasonal influences on treatment, and orthogonal squares experimental designs may be used during DAF and filter evaluation.

### **2.5. EXPECTED PRODUCTS AND OUTCOMES**

The Final Report will present data needed prior to full-scale implementation such as the reliability and costs for achieving the following water quality goals using the AIWPS® Technology: nutrients (<2 mg/L total ammonia nitrogen, <6 mg/L total nitrogen, <0.5 mg/L total phosphorus); pathogens (<2.2 MPN/100 mL total coliform and *E. coli*, <2.2 PFU/100 mL MS2 bacteriophage); gross pollutants (<10 mg/L carbonaceous BOD, <20 mg/L TSS, <2 NTU turbidity); and metals (20% to 90% removal of some metals). Rapid generation of data sets and engineering information tailored to the RWCF could allow the AIWPS® Technology to be evaluated as an alternative in the Stockton Regional Wastewater Control Facility Master Plan.

Another valuable product will be the completion of a Demonstration Facility suitable for investigation of advanced pond designs. An existing pilot activated sludge system at EEHSL could allow side-by-side comparison of the two processes. As new contaminants (e.g., trace toxics and endocrine disruptors) are regulated, treatment technology performance will have to be re-evaluated. The AIWPS® Demonstration Facility will be a valuable and unique research asset. The location of the Facility is ideal due to its close proximity to the expertise and resources of the U.S. EPA Region 9 Laboratory and University of California, Berkeley.

### **2.6. FEASIBILITY**

The proposed modifications to the Richmond AIWPS® Facility are within the capabilities of most general contractors as is the design for the pilot High Rate Ponds for Stockton. The Senior Plant Operations Supervisor of the Stockton RWCF, Tim Anderson, has several sites available at the RWCF for the pilot ponds (see enclosed Letter of Support). Permits are not required for either the Richmond AIWPS® Facility or the proposed Stockton High Rate Ponds. At both locations existing wastewater will be removed from the sewer or primary effluent tanks, treated, and then returned. No new discharge will be created.

## **2.7. SCHEDULE**

The schedule of tasks is shown in Table 1.



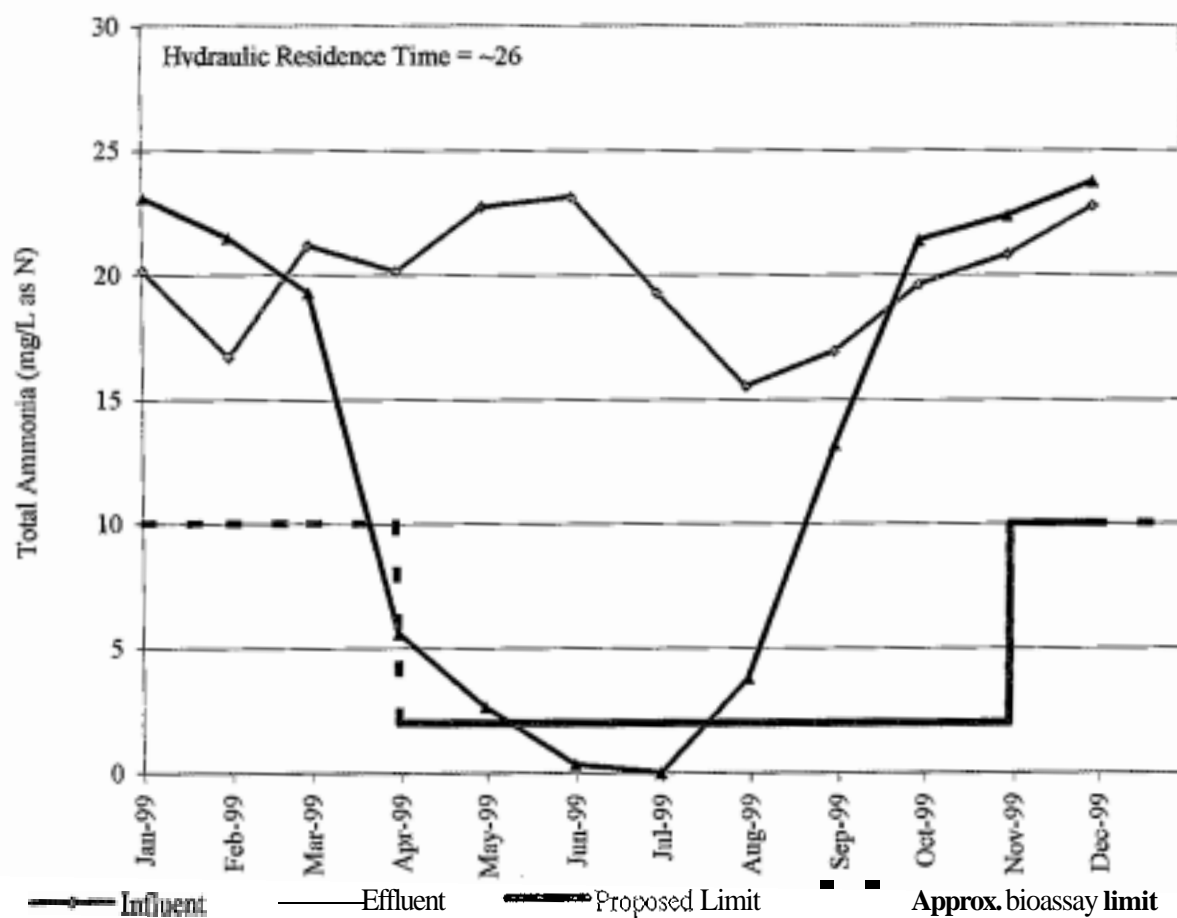


**Table 2.** Metals of the California Toxics Rule removed by the Delhi AIWFS" Facility in twice-weekly composite samples during July and August 1999. Samples collected and analyzed by the U.S. EPA Region 9 Laboratory (unpublished).

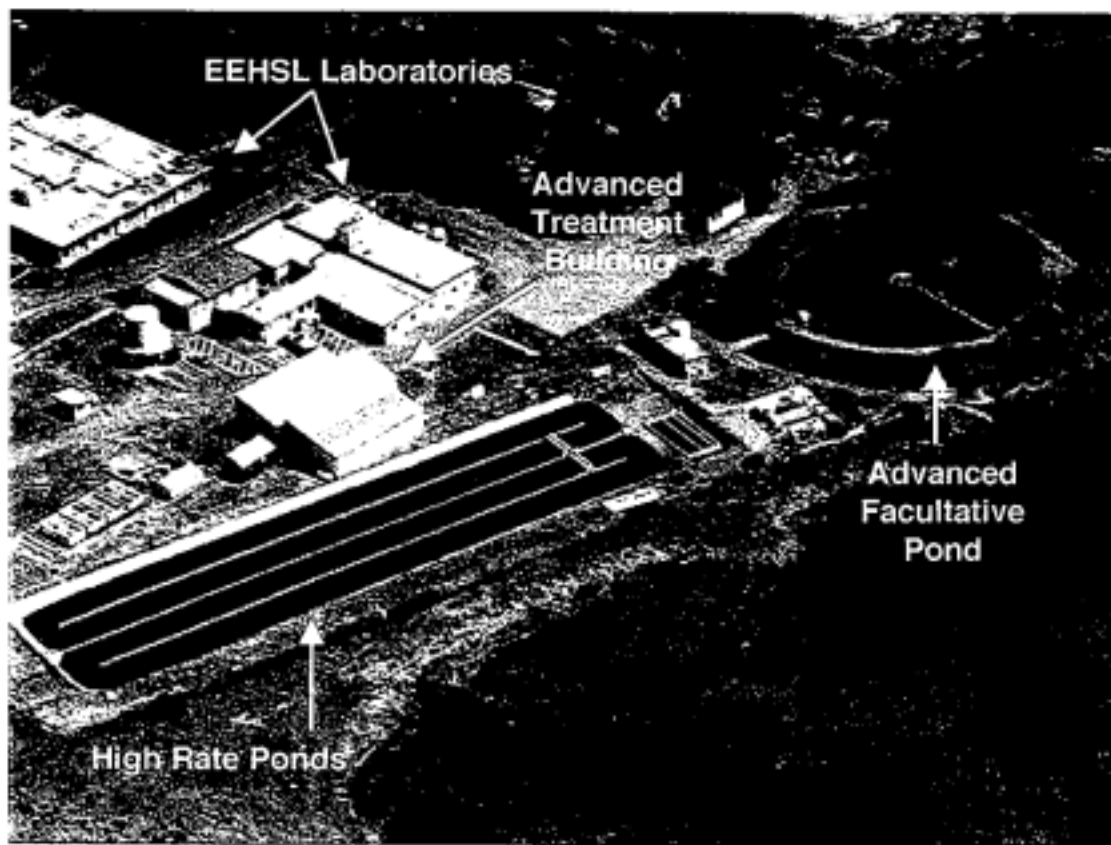
Metal	Influent (µg/L)	Effluent (µg/L)	Percent Removal
Zinc	110	9	92%
Copper	29	6	79%
Lead	2.1	1.2	43%
Arsenic	8	6	25%

**Table 3.** Metals of the California Toxics Rule removed by the first-generation St. Helena AIWPS\* Facility in thrice-weekly composite samples during March 28 to April 13, 1994. Samples collected and analyzed by the U.S. EPA

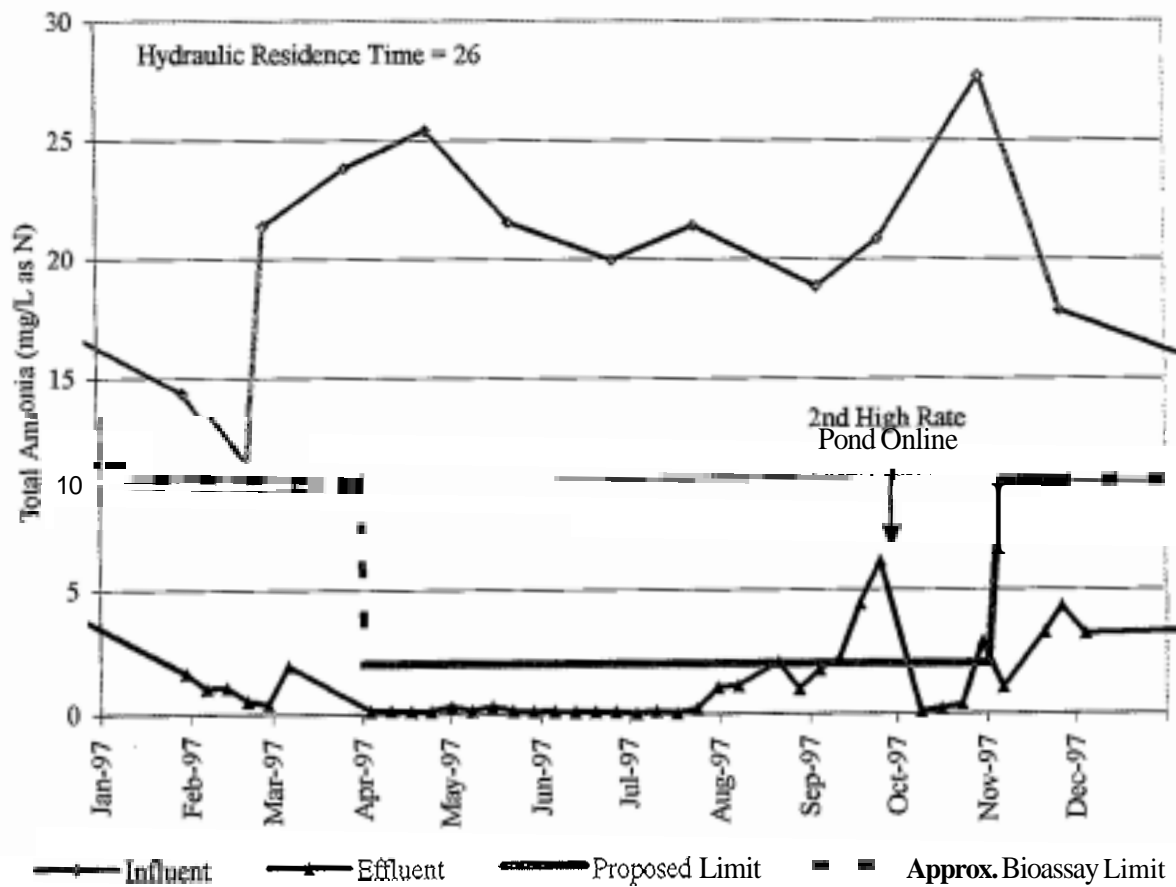
Parameter	Influent (µg/L)	Effluent (µg/L)	Percent Removal
Zinc	140.6	20.6	85%
Copper	47.3	9.5	80%
Mercury	1.0	0.3	70%
Lead	2.6	1.0	62%
Chromium	3.4	2.4	29%



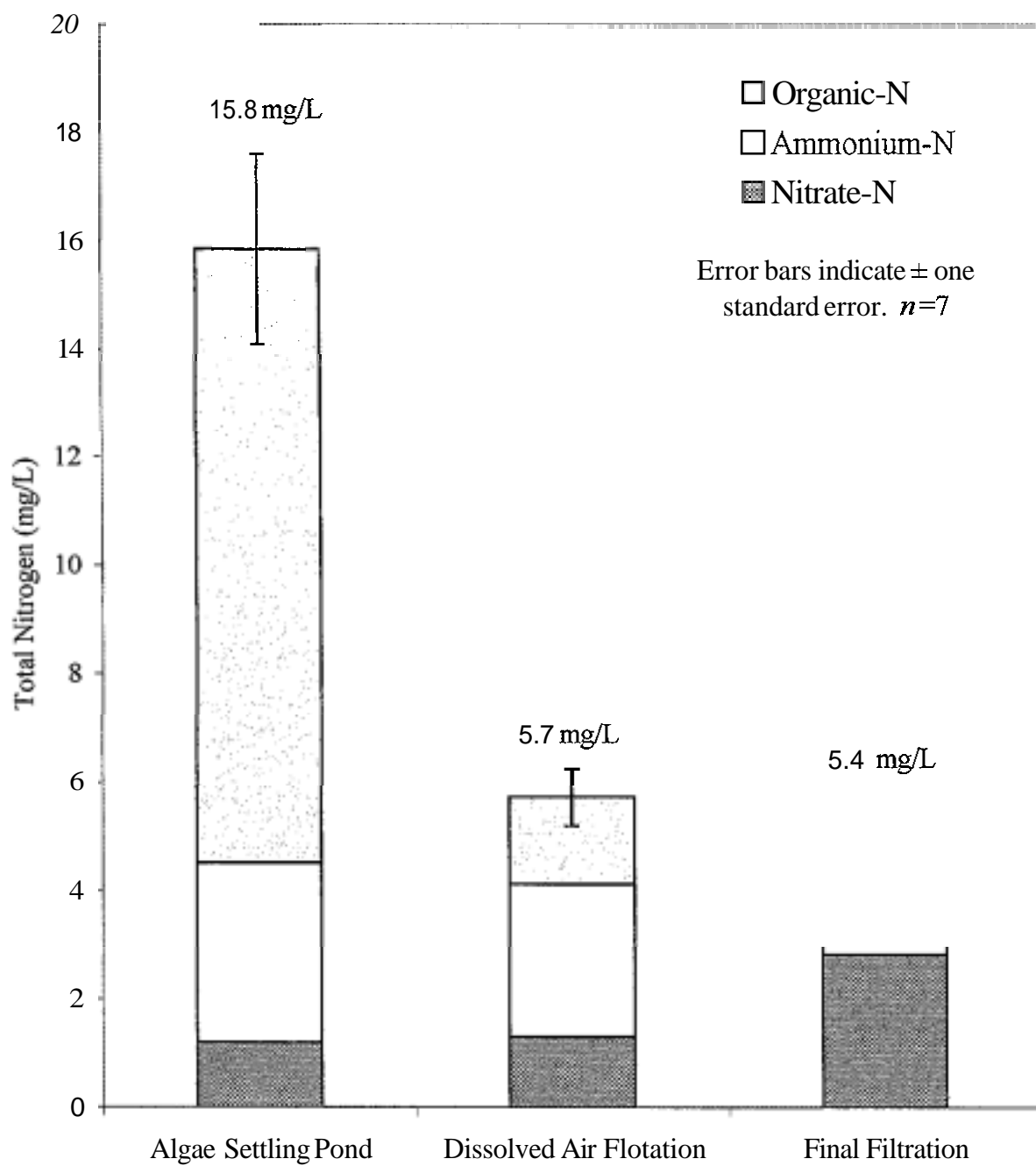
**Figure 1.** Monthly average ammonia nitrogen concentrations and the proposed monthly average limit at the Stockton Regional Wastewater Control Facility.



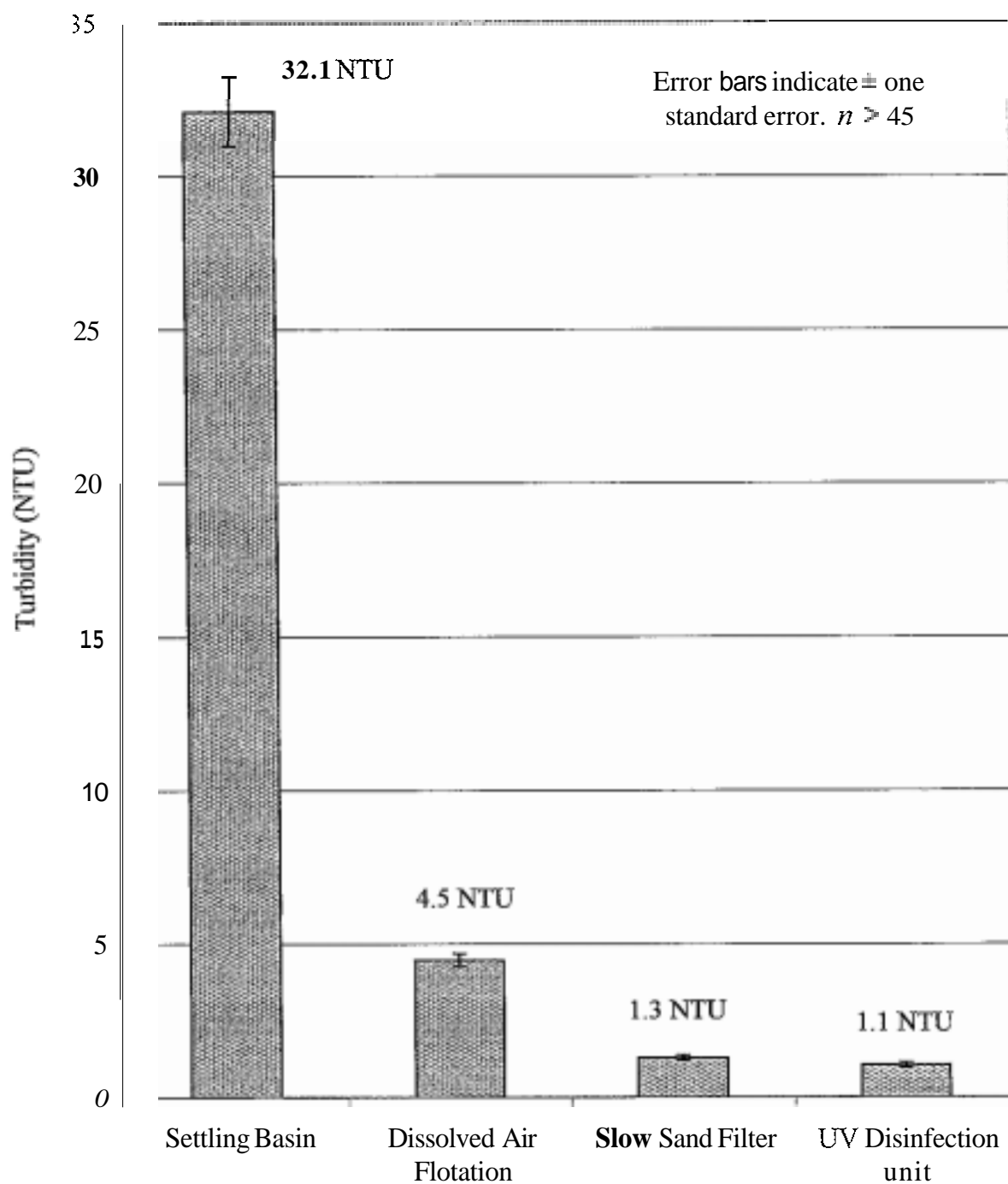
**Figure 2.** The Richmond AIWPS® Demonstration Facility and the Environmental Engineering and Health Sciences Laboratory (EEHSL) at the University of California, Berkeley Richmond Field Station.



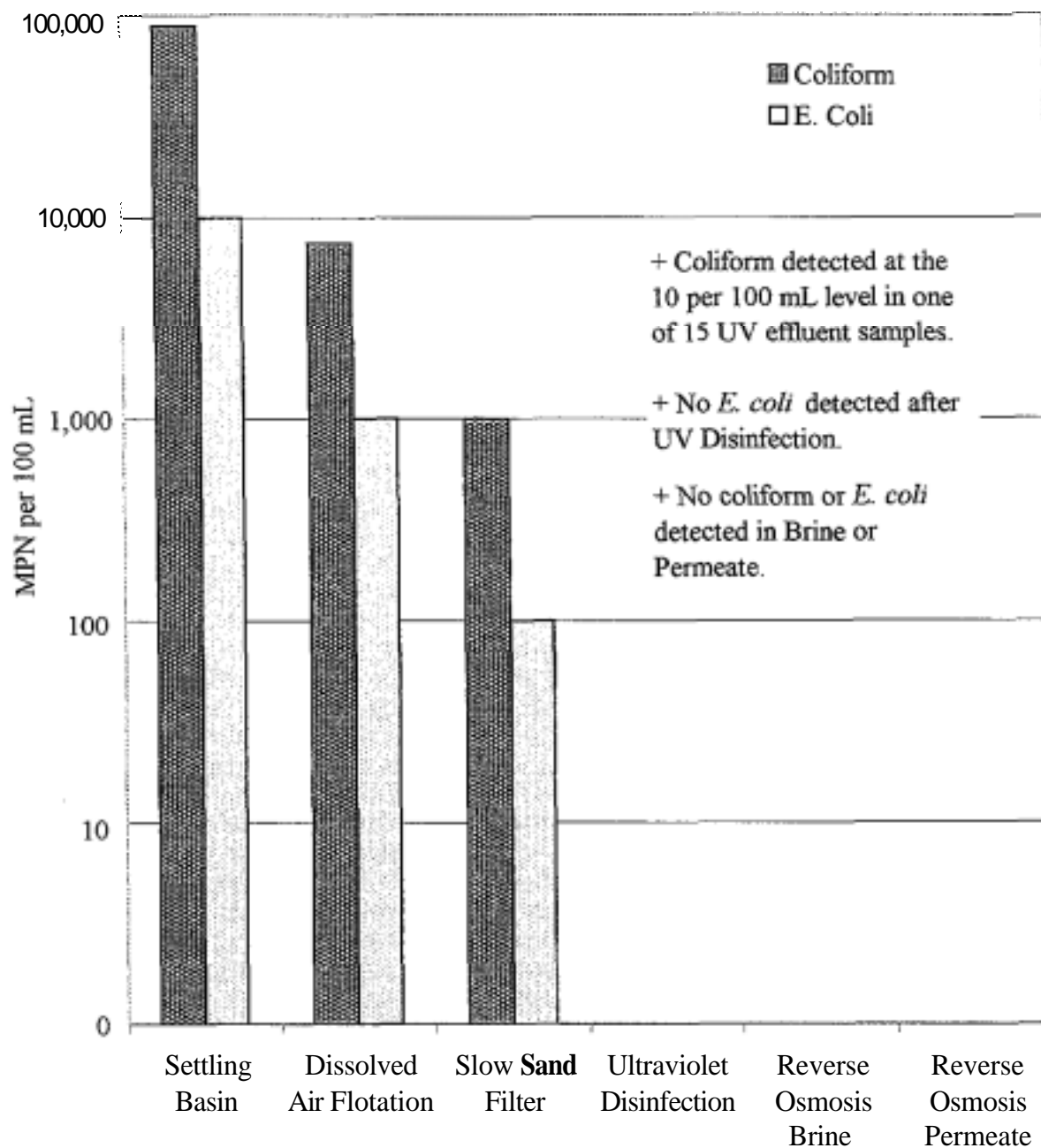
**Figure 3.** Ammonia concentrations at the Richmond AIWPS<sup>®</sup> Demonstration Facility and the proposed monthly average limit for the Stockton Regional Wastewater Control Facility.



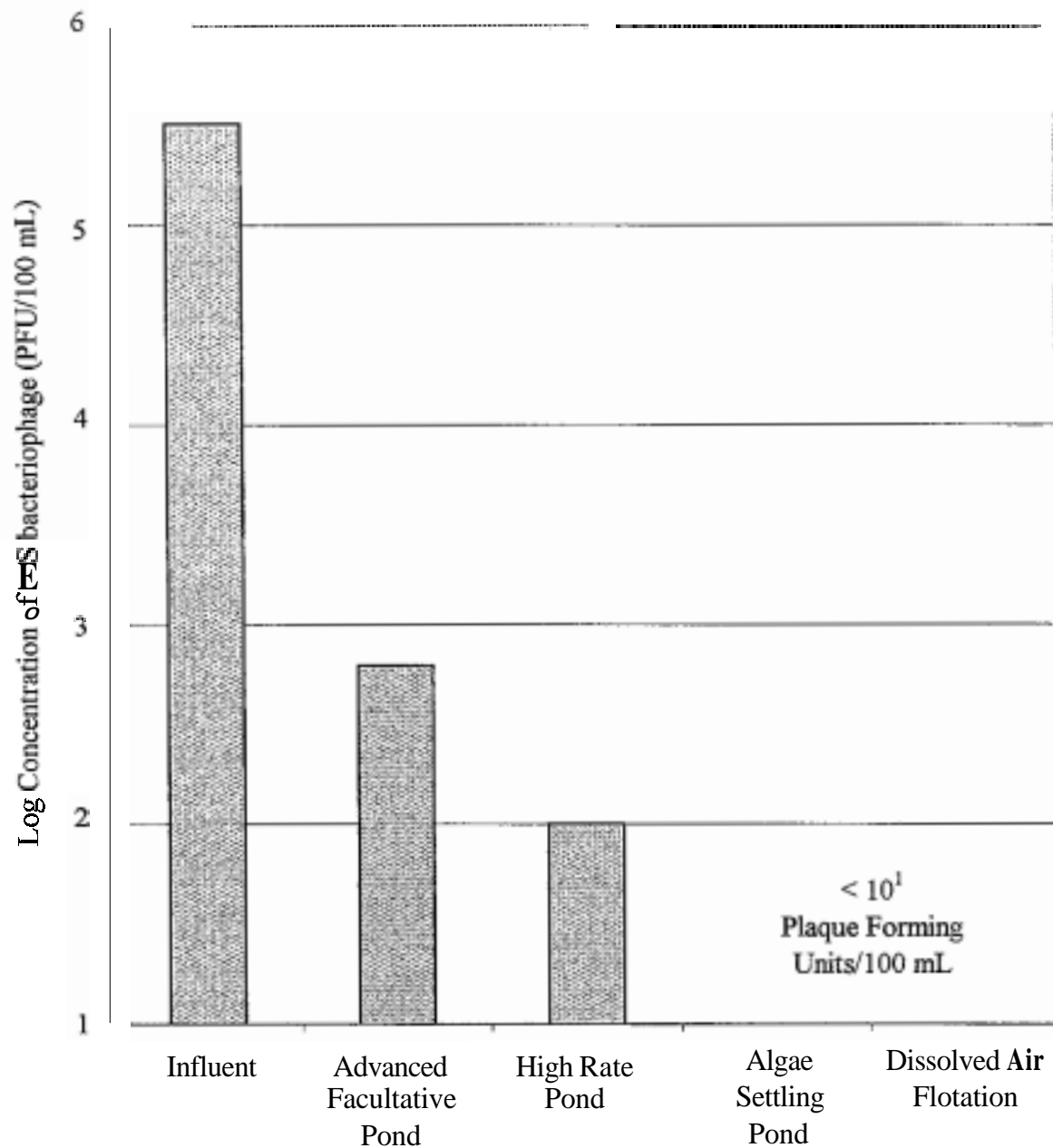
**Figure 4.** Mean effluent total nitrogen concentrations at the Richmond AIWPS® Demonstration Facility during March-June 1999.



**Figure 5.** Mean effluent turbidity at the Richmond AIWPS® Demonstration Facility during February-June 1999.

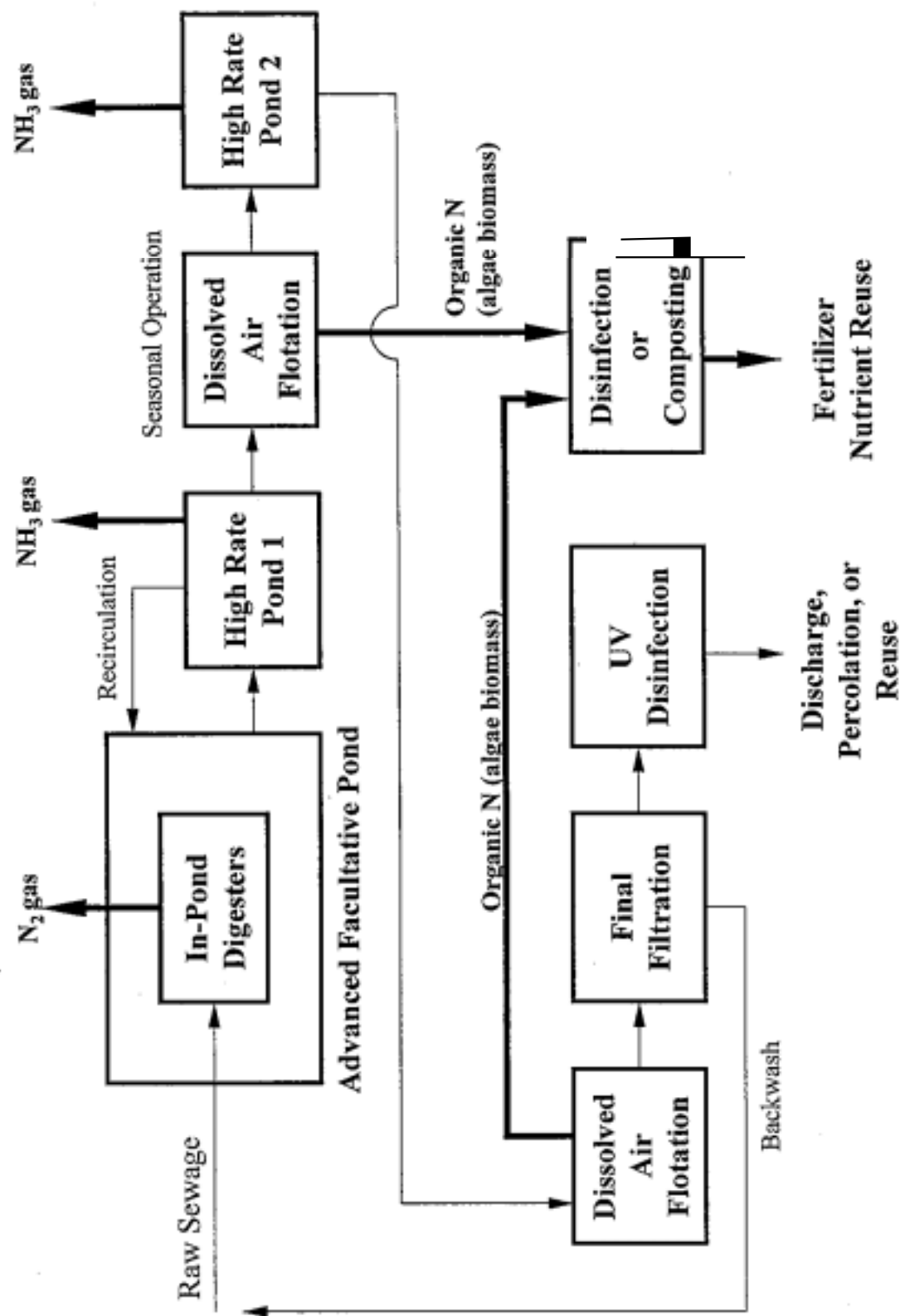


**Figure 6.** Median effluent total coliform and *E. coli* Most Probable Number (MPN) at the Richmond AIWPS<sup>®</sup> Demonstration Facility including reverse osmosis during March-April 1999.

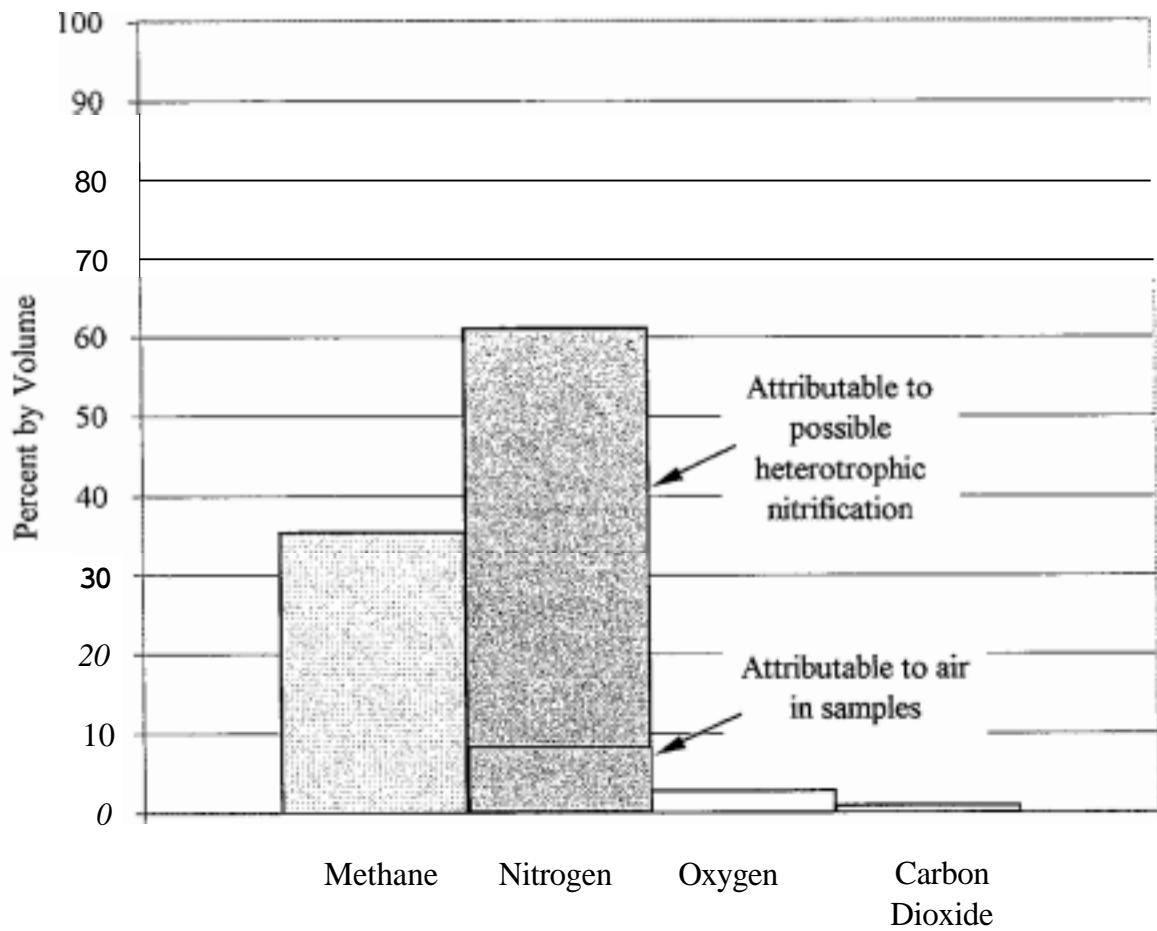


**Figure 7.** Effluent concentrations of indicator virus (Log MS bacteriophage) at the Richmond AIWPS<sup>®</sup> Demonstration Facility on 28 June 1999.  $n = 1$ .





**Figure 8.** Process schematic of the Richmond AIWPS® Demonstration Facility showing nitrogen removal paths.



**Figure 9.** Mean composition of biogas in weekly samples collected 0.7 m above sludge on floor of Digester 1 of the Richmond AIWPS<sup>®</sup> Demonstration Facility during May-September 1992 (Green *et al.*, 1996).

### **3.0. APPLICABILITY TO CVPIA PRIORITIES AND CALFED ERP GOALS**

The proposed research and demonstration project will further CVPIA and CALFED ecosystem restoration goals by providing a new, economical way to remove nutrients and some toxic metals from wastewater prior to its discharge to waterways or recharge to groundwater. These contaminants are direct stressors or lead to stressors such as algae-proliferation in the San Joaquin River. The successful demonstration of AIWPS® Technology will add to the range of alternatives available to water management agencies.

CALFED has funded numerous projects that are synergistic or share similar goals with the proposed project including the demonstration of nitrate and selenium removal from agricultural drainage water with advanced pond designs (1998-B14, Professor William Oswald, PI). Other related projects include the following:

- “Determination of the Causes of San Joaquin River Dissolved Oxygen Depletion”;
- “San Joaquin River Real-time Water Quality Management and Water Quality Forecasting Program”;
- “Implementing Programs to Reduce Fertilizers in Sacramento and San Joaquin Watersheds”;
- “Adaptive Real-Time Water Quality Management of Seasonal Wetlands Quality in the Grassland Water District” (2000-E05); and,
- “Evaluation of Selenium Sources, Levels, and Consequences in the Delta” (1998-B07).

### **3.1. PREVIOUS CVPIA OR CALFED FUNDING**

Professor Oswald’s research group is currently under contract with CALFED to operate and optimize the performance of the demonstration-scale Algal-Bacterial Selenium Removal (ABSR) Facility in the Panoche Drainage District (CALFED Project 98-B14). The ABSR project is similar scale and approach to the proposed project. The ABSR project also overlaps with the proposed project. The ABSR Facility utilizes advanced pond designs and removes 95% of nitrate from agricultural drainage in addition to removing selenium (Zarate *et al.*, 2000; Lundquist *et al.*, 1999; Zarate *et al.*, 1999). Professor Oswald’s group has not received CVPIA funding previously.

### **3.2. SYSTEM-WIDE ECOSYSTEM BENEFITS**

The Bay-Delta ecosystem is being degraded by low river flows and poor water quality (RWQCBICVR, 1998). These problems have many causes, but one area where the causes intersect is management of wastewater from cities, animal facilities, and agricultural drainage. Affordable technology that removes nitrogen from wastewater will improve river quality and flow where the effluent is discharged or runs off land, and it will prevent waste nitrogen from damaging groundwater supplies where the effluent is percolated. Water reuse increases supply, and recovered nitrogen in algal biomass used for fertilizer would offset the import of chemical fertilizer.

### **4.0. QUALIFICATIONS**

A team of three Berkeley laboratories has been assembled to carry out the research and demonstration project proposed. The Applied Algae Research Group at the Environmental Engineering and Health Sciences Laboratory, University of California, Berkeley will be the lead group responsible for project coordination, demonstration facility operation, and engineering experimental design. A commercial lab will perform bacteriophage and salmonella determinations.

The research group of Professor Mary K. Firestone of the Department of Environmental Science, Policy, and Management has extensive expertise and specialized laboratory facilities for the study of nitrogen and pollutant transformations in soils and water. Her group will conduct the experiments and analyses to elucidate the process of heterotrophic nitrification/denitrification in the highly reduced environment of the In-pond Digesters.

H. Scott Mountford, manager of the Lawrence Berkeley National Laboratory's Environmental Measurement Lab (EML), is a professional analytical chemist with a decade's experience in managing analytical laboratories. He participates in numerous research projects, teaches, and has recently developed an analytical method for low-level selenium determination in seawater. The EML is an EPA/California Department of Health Services certified analytical lab within the Earth Sciences Division (ESD) for researchers at DOE laboratories and the University of California. The EML has the capabilities to conduct a wide variety of analyses covering both organic and inorganic methods, including examination of air, water, soil, sediment, seawater, and waste water samples. Some analytical equipment includes ICP-OES, ICP-MS, FLAA, HPLC, ion chromatography, GC-MS, and GC. The trace metals analyses required in the proposed project will be conducted at the EML and integrated with its quality assurance/quality control program.

Professor William J. Oswald, Ph.D., P.E., D.E.E., head of the Applied Algae Research Group, will be the principal investigator for proposed project. He has been working to solve California water and wastewater problems for near five decades. During that time he has conducted research and consulted on hundreds of projects for California municipalities, industries, and agriculture. In addition to his intimate knowledge of the State's water issues, Oswald and his co-workers at the University of California, Berkeley have studied the basic processes occurring in wastewater treatment ponds and developed means to accelerate and improve the treatment process using advanced pond designs. The current state-of-the-art is embodied in the Advanced Integrated Wastewater Pond System (AIWPS®) Technology. Components of the AIWPS® Technology are currently pending patent by the University of California, Berkeley. Oswald also developed the High Rate Pond which is the most widely used apparatus for commercial cultivation of algae for the health food industry.

Professor Oswald will be assisted in project management by two staff members of the Applied Algae Research Group. Bailey Green, Assistant Research Engineer, and Tryg Lundquist, Assistant Specialist, each have more than ten years' experience in managing wastewater treatment research and in full-scale engineering design. Green has a Ph.D. from the Energy and Resources Group, University of California, Berkeley, is an expert in energy consumption and efficiency in wastewater treatment, and pioneered the use of submerged methane gas collectors for ponds. His role will be project management, technology transfer, and engineering analysis. Lundquist is a licensed civil engineer in California and holds an MS in Environmental Engineering from Berkeley. Lundquist will oversee the laboratory analyses for the Applied Algae Research Group. He will be responsible for lab QA/QC and will assist in data and engineering analyses.

The AIWPS® Facility operation and experiment control will be performed by a full-time academic staff person, Glen Anderson. He will be assisted by Green, Lundquist, and Ph.D. candidate Jim Downing (MS thesis topic: RO treatment of pond effluent). Glen Anderson has a BS in civil engineering from Seattle University and an MS in environmental engineering from Berkeley. He has over five-years experience working in water quality management including river management and restoration, biological sampling, wastewater lab analysis, and community surface water treatment plant design.

Analytical work to determine general pollutants, nutrients and will be conducted by research staff and graduate students from the University of California, Berkeley Civil and Environmental Engineering Department and the School of Public Health under the supervision of Lundquist. The analytical methods to be used are all well established, and the required laboratories and analytical instruments are available at the University of California, Berkeley Environmental Engineering and Health Sciences Laboratory or the U.S. EPA Regional 9 Laboratory also located at the Richmond Field Station. This year the Applied Algae Research Group completed two six-week interlaboratory quality control studies with the EPA Region 9 Laboratory. The results show very good correlations between the two labs over all parameters tested (BOD, solids, nitrate+nitrite, ammonia, organic nitrogen, total phosphorus and soluble reactive phosphorus).

## **5.0. BUDGETS**

The budget covers modification of the AIWPS Facility at the Richmond Field Station to the proposed configuration, followed by operation of the Facility according to the experimental plan to achieve optimum nitrogen and metals removal. Weekly sampling and analyses of the influent and effluent of each stage of the system is also included.

The University of California, Berkeley applies 10% overhead to State-funded projects and 50% overhead to Federally-funded projects. Thus, two budgets are presented, one if the project is funded by the State and the other for Federal funding (see attached).

Regarding partial funding, to provide information on the ammonia removal capabilities of the AIWPS® Technology the following tasks must be funded together:

- Task 1. Modify and operate the Richmond Facility
- Task 3. Nitrogen and carbon removal research and performance monitoring
- Task 4. Pathogen removal and reclamation for reuse
- Task 7. Project management, report writing, technology transfer

Task 2, Task 5, and Task 6 will provide more complete information on the costs and engineering requirements of the AIWPS® Technology. This information will greatly speed the evaluation of the AIWPS' Technology by Stockton and the RWQCB. With full funding, maximal information will be gained from the investment in the operation of the Richmond and Stockton Demonstration Facilities. Early project initiation could result in saving many millions of dollars of State or Federal funds.

## **5.1. COST SHARING**

The City Council of Stockton has not yet considered cost sharing for this project. It is possible that considerable in-kind contributions could be made during the construction and operation of the pilot High Rate Ponds at the Stockton RWCF.

Professor Oswald will contribute to this project 25% of his time for in-kind services. This contribution is equivalent to \$41,000 per year for three years. Professor Firestone has an appointment with the California Agricultural Experiment Station. She will contribute her paid time with the Station to the proposed project. Her in-kind services will amount to 3% in the first year and 2% in each of the following two years. These services are valued at \$7,000. The confirmed in-kind contribution totals \$48,000 over three years.

## **6.0. LOCAL INVOLVEMENT**

The near-term needs of the City of Stockton are the prime focus of the project. City personnel such as the Senior Plant Operations Supervisor of the Stockton RWCF, Tim Anderson, will be kept apprised of the project results, and consulted regarding developments in the City's wastewater facilities planning process. Project personnel will make presentations to the Stockton City Council as requested.

## **7.0. COMPLIANCE WITH STANDARD TERMS AND CONDITIONS**

See attached comments from the University of California Sponsored Projects Office.

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## **9.0. THRESHOLD REQUIREMENTS**

Please see attached checklists and forms.

## **NOTIFICATIONS**

The proposed project will be conducted at two sites; the Richmond Field Station, properly of the University of California, Berkeley, and at the Stockton RWCF, property of the City of Stockton. The City's notification is represented by their Letter of Support in the following section.

UNIVERSITY OF CALIFORNIA, BERKELEY

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO



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1371 S. 46th STREET, BLDG. 112  
RICHMOND, CALIFORNIA 94804-4603  
(510) 231-9516 FAX (510) 231-5764

May 10, 2000

Tim Anderson  
Senior Plant Operations Supervisor  
City of Stockton Regional Wastewater Control Facility  
2500 Navy Drive  
Stockton, CA 95206

Dear Tim,

Please find enclosed our *draft* proposal to the CALFED Bay-Delta Program and the CVPIA Fish and Wildlife Restoration Program. The proposal includes the construction and operation of pilot High Rate Ponds at the Regional Wastewater Control Facility in the locations you suggested. A letter of support from the City would be appropriate to include in the proposal. Please let me know if such a letter will be possible. *Thank* you.

Best regards,

A handwritten signature in dark ink, appearing to read "Tryg Lundquist".

Tryg Lundquist  
Applied Algae Research Group

State Funding Budget for "Tertiary and Quaternary Wastewater Treatment for Water Quality Restoration in the Bay-Delta".  
University of California, Berkeley

		Direct Labor Hours	Subject to Overhead						Exempt from Overhead		Total Cost
Year	Task		Salary	Benefits	Travel	Supplies & Expendables	Service Contracts	Overhead (10.0%)	Equipment	Graduate Student Fee Remission	
Year 1	Task 1	2720	\$60,134	\$10,245	\$0	\$21,761	\$0	\$9,214	\$129,000	\$0	\$230,354
	Task 2	1840	\$40,679	\$6,930	\$550	\$14,721	\$0	\$6,288	\$0	\$0	\$69,168
	Task 3	3200	\$70,746	\$3,153	\$0	\$25,602	\$5,120	\$10,462	\$0	\$8,900	\$123,982
	Task 4	2160	\$47,754	\$3,686	\$0	\$17,281	\$0	\$6,872	\$0	\$4,450	\$80,042
	Task 5	576	\$12,734	\$2,169	\$0	\$4,608	\$2,880	\$2,239	\$0	\$0	\$24,631
	Task 6	960	\$21,224	\$3,616	\$0	\$7,680	\$0	\$3,252	\$0	\$0	\$35,772
	Task 7"	1248	\$27,591	\$4,701	\$0	\$9,985	\$0	\$4,228	\$0	\$0	\$46,504
Total Cost Year 1		12,704	\$280,862	\$34,499	\$550	\$101,638	\$8,000	\$42,555	\$129,000	\$13,350	\$610,454
Year 2	Task 1	960	\$21,247	\$3,674	\$0	\$6,411	\$0	\$3,133	\$0	\$0	\$34,465
	Task 2	1200	\$26,559	\$2,201	\$2,873	\$124,264	\$0	\$15,590	\$0	\$2,392	\$173,877
	Task 3	4160	\$92,070	\$11,137	\$0	\$14,781	\$5,120	\$12,311	\$0	\$4,783	\$140,202
	Task 4	2880	\$63,741	\$6,239	\$0	\$25,233	\$0	\$9,521	\$0	\$4,783	\$109,517
	Task 5	576	\$12,748	\$2,204	\$0	\$2,047	\$2,880	\$1,988	\$0	\$0	\$21,867
	Task 6	1920	\$42,494	\$4,956	\$0	\$6,822	\$0	\$5,427	\$0	\$2,392	\$62,091
	Task 7*	1248	\$27,621	\$4,776	\$0	\$4,434	\$0	\$3,683	\$0	\$0	\$40,515
Total Cost Year 2		12,944	\$286,479	\$35,188	\$2,873	\$183,991	\$8,000	\$51,653	\$0	\$14,350	\$582,534
Year 3	Task 1	960	\$24,083	\$4,230	\$0	\$4,067	\$0	\$3,238	\$0	\$0	\$35,618
	Task 2	960	\$24,083	\$373	\$2,873	\$4,067	\$0	\$3,140	\$0	\$3,857	\$38,393
	Task 3	4160	\$104,360	\$14,472	\$0	\$17,625	\$5,120	\$14,158	\$0	\$3,857	\$159,591
	Task 4	2880	\$72,249	\$8,832	\$0	\$12,202	\$0	\$9,328	\$0	\$3,857	\$106,468
	Task 5	480	\$12,041	\$2,115	\$0	\$2,034	\$2,880	\$1,907	\$0	\$0	\$20,977
	Task 6	960	\$24,083	\$373	\$0	\$4,067	\$0	\$2,852	\$0	\$3,857	\$35,232
	Task 7"	1248	\$31,308	\$5,499	\$0	\$5,288	\$0	\$4,209	\$0	\$0	\$46,303
Total Cost Year 3		11,648	\$292,207	\$35,892	\$2,873	\$49,351	\$8,000	\$38,832	\$0	\$15,428	\$442,583
Total Project Cost			\$859,548	\$105,579	\$6,296	\$334,980	\$24,000	\$133,040	\$129,000	\$43,128	\$1,635,571

\* Task 7 consists of project management, data analysis, engineering analysis, and report preparation.

Project management alone requires \$30,000 per year excluding overhead.

Service contracts will be with commercial laboratories conducting bacteriophage and salmonella determination.

Federal Funding Budget for 'Tertiary and Quaternary Wastewater Treatment for Water Quality Restoration in the Bay-Delta'.  
University of California, Berkeley

		Direct Labor Hours	Subject to Overhead						Exempt from Overhead		Total Cost
Year	Task		Salary	Benefits	Travel	Supplies & Expendables	Service Contracts	Overhead (50.4%)	Equipment	Graduate Student Fee Remission	
Year 1	Task 1	2720	\$60,134	\$10,245	\$0	\$21,761	\$0	\$46,438	\$129,000	\$0	\$267,578
	Task 2	1840	\$40,679	\$6,930	\$550	\$14,721	\$0	\$31,691	\$0	\$0	\$94,571
	Task 3	3200	\$70,746	\$3,153	\$0	\$25,602	\$5,120	\$52,728	\$0	\$8,900	\$166,248
	Task 4	2160	\$47,754	\$3,686	\$0	\$17,281	\$0	\$34,635	\$0	\$4,450	\$107,805
	Task 5	576	\$12,734	\$2,169	\$0	\$4,608	\$2,880	\$11,285	\$0	\$0	\$33,677
	Task 6	960	\$21,224	\$3,616	\$0	\$7,680	\$0	\$16,390	\$0	\$0	\$48,910
	Task 7*	1248	\$27,591	\$4,701	\$0	\$9,985	\$0	\$21,307	\$0	\$0	\$63,583
Total Cost Year 1		12,704	\$280,862	\$34,499	\$550	\$101,638	\$8,000	\$214,474	\$129,000	\$13,350	\$782,373
Year 2	Task 1	960	\$21,247	\$3,674	\$0	\$6,411	\$0	\$15,791	\$0	\$0	\$47,123
	Task 2	1200	\$26,559	\$2,201	\$2,873	\$124,264	\$0	\$78,570	\$0	\$2,392	\$236,858
	Task 3	4160	\$92,070	\$11,137	\$0	\$14,781	\$5,120	\$62,045	\$0	\$4,783	\$189,937
	Task 4	2880	\$63,741	\$6,239	\$0	\$25,233	\$0	\$47,986	\$0	\$4,783	\$147,982
	Task 5	576	\$12,748	\$2,204	\$0	\$2,047	\$2,880	\$10,019	\$0	\$0	\$29,898
	Task 6	1920	\$42,494	\$4,956	\$0	\$6,822	\$0	\$27,353	\$0	\$2,392	\$84,016
	Task 7	1248	\$27,621	\$4,776	\$0	\$4,434	\$0	\$18,563	\$0	\$0	\$55,394
Total Cost Year 2		12,944	\$286,479	\$35,188	\$2,873	\$183,991	\$8,000	\$260,327	\$0	\$14,350	\$791,208
Year 3	Task 1	960	\$24,083	\$4,230	\$0	\$4,067	\$0	\$16,319	\$0	\$0	\$48,699
	Task 2	960	\$24,083	\$373	\$2,873	\$4,067	\$0	\$15,823	\$0	\$3,857	\$51,076
	Task 3	4160	\$104,360	\$14,472	\$0	\$17,625	\$5,120	\$71,353	\$0	\$3,857	\$216,786
	Task 4	2880	\$72,249	\$8,832	\$0	\$12,202	\$0	\$47,014	\$0	\$3,857	\$144,154
	Task 5	480	\$12,041	\$2,115	\$0	\$2,034	\$2,880	\$9,611	\$0	\$0	\$28,681
	Task 6	960	\$24,083	\$373	\$0	\$4,067	\$0	\$14,375	\$0	\$3,857	\$46,755
	Task 7*	1248	\$31,308	\$5,499	\$0	\$5,288	\$0	\$21,215	\$0	\$0	\$63,309
Total Cost Year 3		11,648	\$292,207	\$35,892	\$2,873	\$49,351	\$8,000	\$195,710	\$0	\$15,428	\$599,461
Total Project Cost			\$859,548	\$105,579	\$6,296	\$334,980	\$24,000	\$670,511	\$129,000	\$43,128	\$2,173,042

\* Task 7 consists of project management, data analysis, engineering analysis, and report preparation.  
Project management alone requires \$30,000 per year excluding overhead.  
Service contracts will be with commercial laboratories conducting bacteriophage and salmonella determination.

	Monthly Rate	No of Months	%	10/1/2001- 9/30/02	10/1/2002- 9/30/03	10/1/2003- 9/30/04
<b>Personnel</b>						
W. Oswald, PI - research recall	\$13,537	12 cal. year	25%	\$40,611	\$41,423	\$42,251 <sup>1</sup>
Assoc. Res. Engr.	\$6,225	12 cal. yr.	60%	\$44,820	\$45,716	\$46,630 <sup>1</sup>
Asst. Spec.	\$3,430	12 cal. yr.	100%	\$41,160	\$41,983	\$42,823 <sup>1</sup>
Jr. Specialist	\$2,575	12 cal. yr.	100%	\$30,900	\$31,518	\$32,148 <sup>1</sup>
Jr. Specialist	\$2,746	12 cal. yr.	100%	\$32,952	\$33,611	\$34,283 <sup>1</sup>
Staff Res Assist. 2	\$2,758	12 cal. yr.	100%	\$33,096	\$33,758	\$34,433 <sup>1</sup>
Staff Res Assist. 4	\$5,000	12 cal. yr.	17%	\$10,000	\$10,200	\$10,404
1 GSR III	\$2,629	9 ac.yr.	50%	\$11,831	\$12,068	\$12,309
	\$2,629	3 summer	100%	\$7,887	\$8,045	\$8,206
1 GSR II	\$2,629	9 ac.yr.	25%	\$5,915	\$6,033	\$6,154
	\$2,629	3 summer	25%	\$1,972	\$2,011	\$2,051
1 GSR II	\$2,629	9 ac.yr.	50%	\$11,831	\$12,068	\$12,309 <sup>1</sup>
	\$2,629	3 summer	100%	\$7,887	\$8,045	\$8,206 <sup>1</sup>
<b>TOTAL PERSONNEL</b>				\$280,862	\$286,479	\$292,207
<b>Employee Benefits</b>						
	Rates Per Period					
Principal Investigator, research recall	1.93%	1.93%	1.93%	\$784	\$799	\$815
Other Academic Personnel	17.00%	17.00%	17.00%	\$32,798	\$33,454	\$34,123
Graduate Student Researcher, acad. year	1.30%	1.30%	1.30%	\$385	\$392	\$400
Graduate Student Researcher, summer	3.00%	3.00%	3.00%	\$532	\$543	\$554
Full Fee Remission & Hlth. Insur./sem.	\$2,576	\$2,769	\$2,977	\$10,304	\$11,076	\$11,908 <sup>2</sup>
Partial Fee Remission & Hlth. Insur./sem.	\$1,523	\$1,637	\$1,760	\$3,046	\$3,274	\$3,520 <sup>2</sup>
<b>TOTAL EMPLOYEE BENEFITS</b>				\$47,849	\$49,538	\$51,320
<b>TOTAL PERSONNEL &amp; BENEFITS</b>				\$328,711	\$336,017	\$343,527
<b>Equipment</b>						
Krofta dissolved air flotation clarifiers (two @\$48,000)				\$96,000	\$0	\$0
Coagulant dosing pumps, polymer mixer, flocculation tanks				\$15,000	\$0	\$0
Final effluent sand filter				\$10,000	\$0	\$0
UV disinfection unit				\$8,000	\$0	\$0
<b>TOTAL EQUIPMENT</b>				\$129,000	\$0	\$0 <sup>2</sup>
<b>Travel</b>						
1 RT per week, Richmond to Stockton (170 miles @\$325/mile)				\$550	\$2,873	\$2,873
<b>TOTAL TRAVEL</b>				\$550	\$2,873	\$2,873
<b>Other Direct Costs</b>						
Demonstration plant modification materials (Richmond)				\$66,000	\$3,000	\$3,000
Microfilter lease				\$0	\$15,000	\$0
Demonstration High Rate Pond materials (Stockton)				\$0	\$120,000	\$0
Outside labs for bacteriophage and salmonella testing				\$8,000	\$8,000	\$8,000
Lab supplies, NOx & metals analytical equipment charges				\$9,000	\$19,000	\$19,000
Analytical equipment maintenance (organic carbon, Kjeldahl nitrogen, gas chromatograph, particle size distribution)				\$2,000	\$3,000	\$3,000
Laboratory waste disposal				\$2,000	\$3,000	\$3,000
Field supplies (gas collectors, ice chests, small pumps, etc.)				\$5,000	\$3,000	\$3,000
Research Management Services (6.28% of salaries)				\$17,638	\$17,991	\$18,351
<b>TOTAL OTHER DIRECT COSTS</b>				\$109,638	\$191,991	\$57,351
<b>TOTAL DIRECT COSTS</b>				\$567,899	\$530,881	\$403,751
<b>Indirect Costs</b>						
	MTDC					
10.0% of Modified Total Direct Costs	\$425,549	\$516,531	\$388,323	\$42,555	\$51,653	\$38,832
<b>TOTAL AMT. REQUESTED PER YEAR</b>				\$610,454	\$582,534	\$442,583
<b>TOTAL AMOUNT REQUESTED</b>						<u>\$1,635,571</u>

<sup>1</sup> Salary rates shown include a projected 2% cost of living increase effective every October 1st.<sup>2</sup> These items are not subject to indirect costs.

Budget  
(October 1, 2001 - September 30, 2004)

	Monthly Rate	No of Months	%	101112001- 9130102	10/1/2002- 9130103	10/1/2003- 9130104
<b>Personnel</b>						
W. Oswald, PI - research recall	\$13,537	12 cal. year	25%	\$40,611	\$41,423	\$42,251 <sup>1</sup>
Assoc. Res. Engr.	\$6,225	12 cal. yr.	60%	\$44,820	\$45,716	\$46,630 <sup>1</sup>
Asst. Spec.	\$3,430	12 cal. yr.	100%	\$41,160	\$41,983	\$42,823 <sup>1</sup>
Ir. Specialist	\$2,575	12 cal. yr.	100%	\$30,900	\$31,518	\$32,148 <sup>1</sup>
Jr. Specialist	\$2,746	12 cal. yr.	100%	\$32,952	\$33,611	\$34,283 <sup>1</sup>
Staff Res Assist. 2	\$2,758	12 cal. yr.	100%	\$33,096	\$33,758	\$34,433 <sup>1</sup>
Staff Res Assist. 4	\$5,000	12 cal. yr.	17%	\$10,000	\$10,200	\$10,404 <sup>1</sup>
2 GSR II	\$2,629	9 cal. yr.	50%	\$23,661	\$24,134	\$24,617 <sup>1</sup>
	\$2,629	3 summer	100%	\$15,774	\$16,089	\$16,411 <sup>1</sup>
1 GSR III	\$2,629	9 cal. yr.	25%	\$5,915	\$6,033	\$6,154 <sup>1</sup>
	\$2,629	3 summer	25%	\$1,972	\$2,011	\$2,051 <sup>1</sup>
<b>TOTAL PERSONNEL</b>				<b>\$280,861</b>	<b>\$286,476</b>	<b>\$292,205</b>
<b>Employee Benefits</b>						
		<b>Rates Per Period</b>				
Principal Investigator, research recall	1.93%	1.93%	1.93%	\$784	\$799	\$815
Other Academic Personnel	17.00%	17.00%	17.00%	\$32,798	\$33,454	\$34,123
Graduate Student Researcher, acad. year	1.30%	1.30%	1.30%	\$384	\$392	\$400
Graduate Student Researcher, Summer	3.00%	3.00%	3.00%	\$532	\$543	\$554
Full Fee Remission & Hlth. Insur./sem.	\$2,576	\$2,769	\$2,977	\$10,304	\$11,076	\$11,908 <sup>2</sup>
Partial Fee Remission & Hlth. Insur./sem.	\$1,523	\$1,637	\$1,760	\$3,046	\$3,274	\$3,520 <sup>2</sup>
<b>TOTAL EMPLOYEE BENEFITS</b>				<b>\$47,848</b>	<b>\$49,538</b>	<b>\$51,320</b>
<b>TOTAL PERSONNEL &amp; BENEFITS</b>				<b>\$328,709</b>	<b>\$336,014</b>	<b>\$343,525</b>
<b>Equipment</b>						
Krofta dissolved air flotation clarifiers (two @\$48,000)				\$96,000	\$0	\$0
Coagulant dosing pumps, polymer mixer, flocculation tanks				\$15,000	\$0	\$0
Final effluent sand filter				\$10,000	\$0	\$0
UV disinfection unit				\$8,000	\$0	\$0
<b>TOTAL EQUIPMENT</b>				<b>\$129,000</b>	<b>\$0</b>	<b>\$0 <sup>2</sup></b>
<b>Travel</b>						
1 RT per week, Richmond to Stockton (170 miles @ \$.325/mile)				\$550	\$2,873	\$2,873
<b>TOTAL TRAVEL</b>				<b>\$550</b>	<b>\$2,873</b>	<b>\$2,873</b>
<b>Other Direct Costs</b>						
Demonstration plant modification materials (Richmond)				\$66,000	\$3,000	\$3,000
Microfilter lease				\$0	\$15,000	\$0
Demonstration High Rate Pond materials (Stockton)				\$0	\$120,000	\$0
Outside labs for bacteriophage and salmonella testing				\$8,000	\$8,000	\$8,000
Lab supplies, NOx & metals analytical equipment charges				\$9,000	\$19,000	\$19,000
Analytical equipment maintenance (organic carbon, Kjeldahl nitrogen, gas chromatograph, particle size distribution)				\$2,000	\$3,000	\$3,000
Laboratory waste disposal				\$2,000	\$3,000	\$3,000
Field supplies (gas collectors, ice chests, small pumps, etc.)				\$5,000	\$3,000	\$3,000
Research Management Services (6.28% of salaries)				\$17,638	\$17,991	\$18,350
<b>TOTAL OTHER DIRECT COSTS</b>				<b>\$109,638</b>	<b>\$191,991</b>	<b>\$57,350</b>
<b>TOTAL DIRECT COSTS</b>				<b>\$567,897</b>	<b>\$530,878</b>	<b>\$403,748</b>
<b>Indirect Costs</b>						
		<b>MTDC</b>				
50.4% of Modified Total Direct Costs	\$425,547	\$516,528	\$388,320	\$214,476	\$260,330	\$195,713
<b>TOTAL AMT. REQUESTED PER YEAR</b>				<b>\$782,373</b>	<b>\$791,208</b>	<b>\$599,461</b>
<b>TOTAL AMOUNT REQUESTED</b>						<b>\$2,173,042</b>

<sup>1</sup> Salary rates shown include a projected 2% cost of living increase effective every October 1st.

<sup>2</sup> These items are not subject to indirect costs.

## **Equipment purchases in support of "Tertiary and Quaternary Wastewater Treatment for Water Quality Restoration in the Bay-Delta"**

University of California, Berkeley

### **Two Krofta Tech dissolved air flotation (DAF) clarifiers** **\$96,000**

These units are required to remove algae from the High Rate Pond effluents and concentration the algae in a green slurry. In this way, soluble nitrogen that was assimilated by algae can be removed from the water. The slurry is nitrogen-rich, and its safety for use as fertilizer will be studied. This clarification is accomplished in less than 5 minutes residence time when the Krofta Tech units are used. Krofta Tech is a leading manufacturer and innovator in DAF technology. Their equipment has been successfully piloted at the Richmond AIWFS Facility. The Stockton RWCF already employs DAF which will result in substantial savings if the AIWFS Technology is employed there. The DAF used to produce the data shown in this proposal was loaned to EEHSL for the reverse osmosis study. It will not be available for the proposed work.

### **Coagulant dosing pumps, polymer mixing, and flocculation tanks** **\$15,000**

These pieces of equipment prepare and deliver coagulant polymer to the DAFs.

### **Final Effluent Sand Filter** **\$10,000**

The sand filter removes residual algae, pathogens, and turbidity from the DAF effluent. Filtration is required to comply with unrestricted reuse guideline and to comply with recommendations of the Department of Health Services for discharge from the Stockton RWCF.

### **UV Disinfection Unit** **\$8,000**

UV disinfection is a relatively new and simple method of wastewater disinfection. It is used at many activated sludge facilities, but relatively little research has been done on its application to filtered and unfiltered pond effluents. The UV disinfection unit used in the reverse osmosis study could treat only 26 L/min and is not appropriate for the proposed 100-300 L/min trials.

### **Microfilter Lease** **\$15,000**

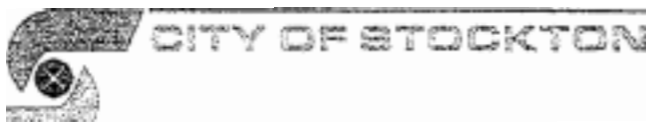
Microfiltration is another relatively new technology that has not been applied extensively to pond effluents. Although microfilters are purported by some manufacturers to operate under high solids loadings (200 mg/L), the fouling rates and backwash frequency may be untenably high. On the other hand, pathogen removal and effluent clarity would be very good. The microfilter will be leased for trials of 3-4 months due to the high cost of purchase.



**LETTERS OF SUPPORT**

Moms L. Allen  
Director of Municipal Utilities  
City of Stockton

Robert Howard  
Water Quality Control Superintendent  
City of Modesto



DEPARTMENT OF MUNICIPAL UTILITIES  
2500 NAVY DRIVE  
STOCKTON, CA 95203-1131  
(209) 937-8750  
FAX (209) 937-8709

May 31, 2000

James J. McKeivitt, Program Manager/Division Chief  
Central Valley Fish and Wildlife Restoration Program  
Sacramento Fish and Wildlife Office  
2800 Cottage Way, Suite W-2605  
Sacramento, C.A. 95825-1846

**LETTER OF SUPPORT FOR THE PILOT STUDY ON ADVANCED INTEGRATED  
WASTEWATER POND SYSTEMS TO BE CONDUCTED BY THE APPLIED ALGAE  
RESEARCH GROUP AT THE ENVIRONMENTAL ENGINEERING AND HEALTH  
SCIENCE LABORATORY, UNIVERSITY OF CALIFORNIA, BERKELEY**

The Municipal Utilities Department would like to express its strong support for the grant application to fund the "Advanced Integrated Wastewater Pond Systems (AIWPS) pilot study which will be conducted by Professor William J. Oswald, PhD, P.E., D.E.F., head of the Applied Algae Research Group for the Environmental Engineering and Health Science Laboratory, University of California, Berkeley.

Control of nitrogen and trace toxics, such as arsenic, copper, lead, and mercury is an immediate concern from various dischargers (municipal, agricultural, food processors, etc.) within the San Joaquin River and the larger Bay-Delta ecosystem. Alternative options must be explored that offer a more economical method of providing treatment to these discharges. AIWPS is one such alternative that offers both an economical construction and operation & maintenance cost. However, the pilot study proposed in the application is necessary to demonstrate the efficacy of this technological approach. The City of Stockton's Regional Wastewater Control Facility offers an excellent site as one of the places to conduct this pilot, as offered in the grant application package.

If you have any questions, please contact me at (209) 937-8700

MORRIS L. ALLEN  
DIRECTOR OF MUNICIPAL UTILITIES

MLA:DMD:dd

cc: Donald Dodge, Assistant Director of Municipal Utilities/EM  
Tun Anderson, Senior Plant Operations Supervisor/Engineering  
Professor William J. Oswald, University of California, Berkeley

May 12, 2000

Professor William J. Oswald  
University of California, Berkeley  
1301 South 46<sup>th</sup> St. Bldg. 112  
Richmond, CA 94804  
Fax: 510-231-5764

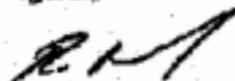
Dear Mr. Lundquist,

I appreciate Tryg Lundquist's telephone call asking for our support of the Advanced Integrated Wastewater Pond System (AIWPS) pilot high rate ponds proposed at the City of Stockton Regional Water Quality Facility. Mr. Lundquist works at the University of California Environmental Engineering and Health Science Laboratory Richmond Field Station.

The proposed research is important. Many wastewater treatment agencies are faced with the requirement to nitrify and possibly provide additional metals removal. The systems as proposed by the University of California appear to offer a lower cost and efficient alternative to more conventional tertiary methodologies.

I am very supportive of the research proposed by the University of California at Richmond and City of Stockton.

Regards,



Robert Howard  
City of Modesto Water Quality Control Superintendent

## Land Use Checklist

All applicants must fill out this Land Use Checklist for their proposal. Applications must contain answers to the following questions to be responsive and to be considered for funding. Failure to answer these questions and include them with the application will result in the application being considered nonresponsive and not considered for funding.

1. Do the actions in the proposal involve physical changes to the land (i.e. grading, planting **vegetation**, or breaching levees) or restrictions in land **use** (i.e. conservation easement or placement of land in a wildlife refuge)?

            
YES

  XX    
NO

2. If NO to # 1, explain what type of actions are involved in the proposal (i.e., research only, planning only).

No grading will be required at the existing demonstration facility.  
New demonstration ponds at Stockton Regional Wastewater Control Facility

3. If YES to #1, what is the proposed land use change or restriction under the proposal?

4. If YES to # 1, is the land currently under a Williamson Act contract?

            
YES

  X    
NO

5. If YES to # 1, answer the following:

Current land **use**

Current zoning

Current general plan designation

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

6. If YES to #1, is the land classified as Prime Farmland, Farmland of Statewide Importance or Unique Farmland on the Department of Conservation Important Farmland Maps?

            
YES

            
NO

            
DON'T KNOW

7. If YES to # 1, how many acres of land will be subject to physical change or land **use** restrictions under the proposal?

\_\_\_\_\_

8. If YES to # 1, is the property currently being commercially farmed or grazed?

            
YES

            
NO

9. If YES to #8, what are

the number of employees/acre \_\_\_\_\_

the total number of employees \_\_\_\_\_

10. Will the applicant acquire any interest in land under the proposal (fee title or a conservation easement)?

YES

xx  
NO

11. What entity/organization will hold the interest? no land transactions involved

12. If YES to # 10, answer the following:

Total number of acres to be acquired under proposal

Number of acres to be acquired in fee

Number of acres to be subject to conservation easement

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

13. For all proposals involving physical changes to the land or restriction in land use, describe what entity or organization will: NA

manage the property

provide operations and maintenance services

conduct monitoring

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

14. For land acquisitions (fee title or easements), will existing water rights also be acquired? NA

YES

NO

15. Does the applicant propose any modifications to the water right or change in the delivery of the water?

YES

xx  
NO

16. If YES to # 15, describe

\_\_\_\_\_

All applicants must fill out this Environmental Compliance Checklist. Applications must contain answers to the following questions to be responsive and to be considered for funding. Failure to answer these questions and include them with the application will result in the application being considered nonresponsive and not considered for funding.

- YES NO

- 
- Lead Agency

4. If CEQNEPA compliance is required, describe how the project will comply with either or both of these laws. Describe where the project is in the compliance process and the expected date of completion.

- |            |   |           |
|------------|---|-----------|
| <b>xx</b>  | Stockton Regional Wastewater Control Facility |           |
| <u>YES</u> |   | <u>NO</u> |

If yes, the applicant **must** attach written permission for **access** from the relevant property owner(s). Failure to include written permission for access may result in disqualification **of** the proposal during the review process. Research and monitoring field projects for which specific field locations have not been identified will be required to provide access needs and permission for access with **30** days of notification of approval.

6. Please indicate what permits or other approvals may be required for the activities contained in your proposal. Check all boxes that apply.

**LOCAL**

Conditional use permit  
 Variance  
 Subdivision Map Act approval  
 Grading permit  
 General plan amendment  
 Specific plan approval  
~~Reason~~  
 Williamson Act Contract  
 cancellation  
 Other \_\_\_\_\_  
 (please specify)  
 None required

<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	
<input checked="" type="checkbox"/>	

**STATE**

CESA Compliance  
 Streambed alteration permit  
 CWA § 401 certification  
 Coastal development permit  
 Reclamation Board approval  
 Notification  
 Other \_\_\_\_\_  
 (please specify)  
 None required

<input type="checkbox"/>	(CDFG)
<input type="checkbox"/>	(CDFG)
<input type="checkbox"/>	(RWQCB)
<input type="checkbox"/>	(Coastal Commission/BCDC)
<input type="checkbox"/>	
<input type="checkbox"/>	(DPC, BCDC)
<input type="checkbox"/>	
<input checked="" type="checkbox"/>	

**FEDERAL**

ESA Consultation  
 Rivers & Harbors Act permit  
 CWA § 404 permit  
 Other \_\_\_\_\_  
 (please specify)  
 None required

<input type="checkbox"/>	(USFWS)
<input type="checkbox"/>	(ACOE)
<input type="checkbox"/>	(ACOE)
<input checked="" type="checkbox"/>	

DPC = Delta Protection Commission  
 CWA = Clean Water Act  
 CESA = California Endangered Species Act  
 USFWS = US Fish and Wildlife Service  
 ACOE = U.S. Army Corps of Engineers

ESA = Endangered Species Act  
 CDFG = California Department of Fish and Game  
 RWQCB = Regional Water Quality Control Board  
 BCDC = Bay Conservation and Development Comm.

**NONDISCRIMINATION COMPLIANCE STATEMENT**

STD. 19 (REV. 3-95)

COMPANY NAME

University of California, Berkeley

The company named above (hereinafter referred to as "prospective contractor") hereby certifies, unless specifically exempted, compliance with Government Code Section 12990(a-f) and California Code of Regulations, Title 2, Division 4, Chapter 5 in matters relating to reporting requirements and the development, implementation and maintenance of a Nondiscrimination Program. Prospective contractor agrees not to unlawfully discriminate, harass or allow harassment against any employee or applicant for employment because of sex, race, color, ancestry, religious creed, national origin, physical disability (including HIV and AIDS), medical condition (cancer), age (over 40), marital status, denial of family care leave and denial of pregnancy disability leave.

**CERTIFICATION**

*I, the official named below, hereby swear that I am duly authorized to legally bind the prospective contractor to the above described certification. I am fully aware that this certification, executed on the date and in the county below, is made under penalty of perjury under the laws of the State of California.*

*for*Patricia A. Gates  
Sr. Research Administrator

OFFICIAL'S NAME

DATE EXECUTED

*6/2/00*

EXECUTED IN THE COUNTY OF

*Alameda*

PROSPECTIVE CONTRACTOR'S SIGNATURE

*David Garcia*

PROSPECTIVE CONTRACTOR'S TITLE

PROSPECTIVE CONTRACTOR'S LEGAL BUSINESS NAME

**THE REGENTS OF THE UNIVERSITY OF CALIFORNIA**



APPLICATION FOR  
FEDERAL ASSISTANCE

## 1. TYPE OF SUBMISSION:

Application

☐ construction

Preapplication

☐ Construction☒ Non-Construction☐ Non-Construction

2. DATE SUBMITTED

Applicant Identifier

EEHSL - 2244

3. DATE RECEIVED BY STATE

State Application Identifier

4. DATE RECEIVED BY FEDERAL AGENCY

Federal Identifier

## 5 APPLICANT INFORMATION

IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY?

YES ☐ NO ☒

IF YES, LIST ACRONYM(S)

Legal Name

The Regents of The University of California

Address (give city, county, state, and zip code)

University of California  
Sponsored Projects Office  
336 Sproul Hall  
Berkeley, CA 94720-5940

Organizational Unit

Sponsored Projects Office

Name and telephone number of the person to be contacted on matters involving this application (give area code)

Administrative Contact: Pat Gates  
510-642-8109  
Technical Contact: William Oswald 510-231-9438

## 6 EMPLOYER IDENTIFICATION NUMBER (EIN):

9 4 - 6 0 0 2 1 2 3

## 8 TYPE OF APPLICATION

☒ New☐ Continuation☐ Revision

Revision enter appropriate letter(s) in box(es):

A. Increase Award

B. Decrease Award

C. Increase Duration

D. Decrease Duration

Other (specify):

## 7. TYPE OF APPLICANT: (enter appropriate letter in box)

- A. State  
B. County  
C. Municipal  
D. Township  
E. Interstate  
F. Intermunicipal  
G. Special District  
H. Independent School Dist.  
I. State Controlled Institution of Higher Learning  
J. Private University  
K. Indian Tribe  
L. Individual  
M. Profit Organization  
N. Other (Specify):

## 9. NAME OF FEDERAL AGENCY

US Bureau of Reclamation  
Fish and Wildlife Service

## 10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER:

TITLE

## 12. AREAS AFFECTED BY PROJECT (cities, counties, states, etc.):

City of Stockton, San Joaquin River &amp; Bay-Delta

## 11. DESCRIPTIVE TITLE OF APPLICANT'S PROJECT:

Tertiary and Quaternary Wastewater Treatment  
for Water Quality Restoration within the Bay-Delta

## 13. PROPOSED PROJECT:

Start Date

10/1/2001

Ending Date

9/30/2004

## 14. CONGRESSIONAL DISTRICTS OF

a. Applicant

Ninth

b. Project

Seventh and Eleventh

## 15. ESTIMATED FUNDING

a. Federal	\$ 2,173,042.00
b. Applicant	130,000.00
c. State	
d. Local	
e. Other	
f. Program Income	
g. TOTAL	2,303,042.00

## 16. IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS?

- a. YES THIS PREAPPLICATION/APPLICATION WAS MADE AVAILABLE TO THE STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON DATE
- b. NO ☐ PROGRAM IS NOT COVERED BY E.O. 12372
- ☐ OR PROGAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW

## 17. IS THE APPLICANT DELINQUENT ON ANY FEDERAL DEBT?

☐ Yes

If "Yes," attach an explanation.

☒ NO

18. TO THE BEST OF MY KNOWLEDGE AND BELIEF, ALL DATA IN THIS APPLICATION/PREAPPLICATION ARE TRUE AND CORRECT, THE DOCUMENT HAS BEEN DULY AUTHORIZED BY THE GOVERNING BODY OF THE APPLICANT AND THE APPLICANT WILL COMPLY WITH THE ATTACHED ASSURANCES IF THE ASSISTANCE IS AWARDED

a. Typed Name of Authorized Representative

Pat Gates

b. Title

Senior Research Administrator

c. Telephone number

510-642-8109

d. Signature of Authorized Representative

e. Date Signed

6/2/02

# BUDGET INFORMATION - Non-Construction Programs

## SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. Update facility		\$	\$	\$ 363,400	\$ 17,571	\$380,971
2. Stockton pilot				\$382,506	\$17,571	\$400,077
3. Performance				\$572,971	\$24,571	\$597,542
4. Reuse studies				\$399,940	\$17,571	\$417,511
5. Biomass studies				\$92,257	\$17,571	\$109,828
6. Metals removal				\$179,682	\$17,571	\$197,253
7. Project Manag. etc.				\$182,286	\$17,574	\$199,860
8. TOTALS		\$0	\$0	\$2,173,042	\$130,000	\$2,303,042

## SECTION B - BUDGET CATEGORIES

6. OBJECT CLASS CATEGORIES	GRANT PROGRAM, FUNCTION OR ACTIVITY							Total (5)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
a. Personnel	\$ 116,926	\$ 102,782	\$ 282,615	\$ 195,205	\$ 48,986	\$ 99,262	\$ 97,983	\$943,759
b. Fringe Benefits	\$ 18,370	\$ 9,725	\$ 29,659	\$ 18,977	\$ 6,710	\$ 9,166	\$ 15,197	\$107,804
c. Travel	\$0	\$ 6,296	\$0	\$0	\$0	\$0	\$0	\$6,296
d. Equipment	\$129,000	\$0	\$0	\$0	\$0	\$0	\$0	\$129,000
e. Supplies	\$ 32,240	\$143,052	\$ 58,008	\$ 54,716	\$ 8,689	\$ 18,570	\$ 19,706	\$334,980
f. Contractual	\$0	\$0	\$ 15,360	\$0	\$ 8,640	\$0	\$0	\$24,000
g. Construction	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
h. Other (graduate student fee remission)	\$0	\$ 6,249	\$ 17,540	\$ 13,090	\$0	\$ 6,249	\$0	\$43,128
i. Total Direct Charges (sum of 6a-6h)	\$296,535	\$268,104	\$403,182	\$281,989	\$ 73,024	\$133,247	\$132,886	\$1,588,967
j. Indirect Charges	\$ 84,436	\$131,973	\$194,360	\$135,522	\$ 36,804	\$ 64,006	\$ 66,974	\$714,075
k. TOTALS (sum of 6i and 6j)	\$ 380,971	\$400,077	\$597,542	\$417,511	\$109,828	\$197,253	\$199,860	\$2,303,042
7. PROGRAM INCOME	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

SECTION C - NON FEDERAL RESOURCES				
(a) Grant Program	(b) Applicant	(c) State	(d) Other sources	(e) TOTALS
8. Professor William J. Oswald	\$123,000	\$0	\$0	\$123,000
9. Professor Mary K. Firestone	\$7,000	\$0	\$0	\$7,000
10.				\$0
11.				\$0
12. TOTALS (sum of lines 8 and 11)	\$130,000	\$0	\$0	\$130,000

SECTION D - FORECASTED CASH NEEDS					
	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	\$782,373	\$292,343	\$163,343	\$163,343	\$163,343
14. NonFederal	\$49,000	\$12,250	\$12,250	\$12,250	\$12,250
15. TOTAL (sum of lines 13 and 14)	\$831,373	\$304,593	\$175,593	\$175,593	\$175,593

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT				
(a) Grant Program	FUTURE FUNDING PERIODS (YEARS)			
	(b) First	(c) Second	(d) Third	(e) Fourth
16.	\$	\$791,208	\$599,461	\$
17.				
18.				
19.				
20. TOTALS (sum of lines 16 - 19)	\$0	\$791,208	\$599,461	\$0

SECTION F - OTHER BUDGET INFORMATION		
21. Direct Charges: \$1,502,523	22. Indirect Charges \$1,330,395 \$670,519	Base (Modified Total Direct Cost) Total Indirect Expense (50.4% MTDC - Predetermined)
23. Remarks		

**ASSURANCES - NON-CONSTRUCTION PROGRAMS**

Public reporting burden for this collection of information is estimated to average 15 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0040), Washington, DC 20503.

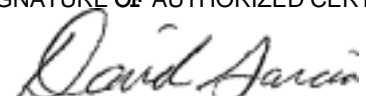

**PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE OFFICE OF MANAGEMENT AND BUDGET. SEND IT TO THE ADDRESS PROVIDED BY THE SPONSORING AGENCY.**

NOTE Certain of these assurances may not be applicable to your project or program. If you have questions, please contact the awarding agency. Further, certain Federal awarding agencies may require applicants to certify to additional assurances. If such is the case, you will be notified.

As the duly authorized representative of the applicant, I certify that the applicant:

1. Has the legal authority to apply for Federal assistance and the institutional, managerial and financial capability (including funds sufficient to pay the non-Federal share of project cost) to ensure proper planning, management and completion of the project described in this application.
2. Will give the awarding agency, the Comptroller General of the United States and, if appropriate, the State, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to the award; and will establish a proper accounting system in accordance with generally accepted accounting standards or agency directives.
3. Will establish safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest, or personal gain.
4. Will initiate and complete the work within the applicable time frame after receipt of approval of the awarding agency.
5. Will comply with the Intergovernmental Personnel Act of 1970 (42 U.S.C. §§4728-4763) relating to prescribed standards for merit systems for programs funded under one of the 19 statutes or regulations specified in Appendix A of OPM's Standards for a Merit System of Personnel Administration (5C.F.R. 900, Subpart F).
6. Will comply with all Federal statutes relating to nondiscrimination. These include but are not limited to: (a) Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin; (b) Title IX of the Education Amendments of 1972, as amended (20 U.S.C. §§1681-1683, and 1685-1686), which prohibits discrimination on the basis of sex; (c) Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. §794), which prohibits discrimination on the basis of handicaps; (d) the Age Discrimination Act of 1975, as amended (42 U.S.C. §§6101-6107), which prohibits discrimination on the basis of age; (e) the Drug Abuse Prevention and Treatment Act of 1972 (P.L. 92-255), as amended, relating to nondiscrimination on the basis of drug abuse; (f) the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970 (P.L. 91-616), as amended, relating to nondiscrimination on the basis of alcohol abuse or alcoholism; (g) §§523 and 527 of the Public Health Service Act of 1912 (42 U.S.C. §§290 dd-3 and 290 ee 3), as amended, relating to confidentiality of alcohol and drug abuse patient records; (h) Title VIII of the Civil Rights Act of 1968 (42 U.S.C. §§3601 et seq.), as amended, relating to nondiscrimination in the sale, rental or financing of housing; (i) any other nondiscrimination provisions in the specific statute(s) under which application for Federal assistance is being made; and, (j) the requirements of any other nondiscrimination statute(s) which may apply to the application.
7. Will comply, or has already complied, with the requirements of Titles II and III of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646) which provide for fair and equitable treatment of persons displaced or whose property is acquired as a result of Federal or federally-assisted programs. These requirements apply to all interests in real property acquired for project purposes regardless of Federal participation in purchases.
8. Will comply, as applicable, with provisions of the Hatch Act (5 U.S.C. §§1501-1508 and 7324-7328) which limit the political activities of employees whose principal employment activities are funded in whole or in part with Federal funds.

9. Will comply, as applicable, with the provisions of the Davis-Bacon Act (40 U.S.C. §§276a to 276a-7), the Copeland Act (40 U.S.C. §276c and 18 U.S.C. §874), and the Contract Work Hours and Safety Standards Act (40 U.S.C. §§327-333), regarding labor standards for federally-assisted construction subagreements.
10. Will comply, if applicable, with Flood insurance purchase requirements of Section 102(a) of the Flood Disaster Protection Act of 1973 (P.L. 93-234) which requires recipients in a special flood hazard area to participate in the program and to purchase flood insurance if the total cost of insurable construction and acquisition is \$10,000 or more.
11. Will comply with environmental standards which may be prescribed pursuant to the following: (a) institution of environmental quality control measures under the National Environmental Policy Act of 1969 (P.L. 91-190) and Executive Order (EO) 11514; (b) notification of violating facilities pursuant to EO 11738; (c) protection of wetlands pursuant to EO 11990; (d) evaluation of flood hazards in floodplains in accordance with EO 11988; (e) assurance of project consistency with the approved State management program developed under the Coastal Zone Management Act of 1972 (16 U.S.C. §§1451 et seq.); (f) conformity of Federal actions to State (Clean Air) Implementation Plans under Section 176(c) of the Clean Air Act of 1955, as amended (42 U.S.C. §§7401 et seq.); (g) protection of underground sources of drinking water under the Safe Drinking Water Act of 1974, as amended (P.L. 93-523); and, (h) protection of endangered species under the Endangered Species Act of 1973, as amended (P.L. 93-205).
12. Will comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. §§1271 et seq.) related to protecting components or potential components of the national wild and scenic rivers system.
13. Will assist the awarding agency in assuring compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. §470), EO 11593 (identification and protection of historic properties), and the Archaeological and Historic Preservation Act of 1974 (16 U.S.C. §§469a-1 et seq.).
14. Will comply with P.L. 93-348 regarding the protection of human subjects involved in research, development, and related activities supported by this award of assistance.
15. Will comply with the Laboratory Animal Welfare Act of 1966 (P.L. 89-544, as amended, 7 U.S.C. §§2131 et seq.) pertaining to the care, handling, and treatment of warm blooded animals held for research, teaching, or other activities supported by this award of assistance.
16. Will comply with the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. §§4801 et seq.) which prohibits the use of lead-based paint in construction or rehabilitation of residence structures.
17. Will cause to be performed the required financial and compliance audits in accordance with the Single Audit Act Amendments of 1996 and OMB Circular No. A-133, "Audits of States, Local Governments, and Non-Profit Organizations."
18. Will comply with all applicable requirements of all other Federal laws, executive orders, regulations, and policies governing this program.

SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL 	TITLE for Patricia A. Gates Sr. Research Administrator
APPLICANT ORGANIZATION 	DATE SUBMITTED 6/2/00

U.S. Department of the Interior

Certifications Regarding Debarment Suspension and  
Other Responsibility Matters, **Drug-Free** Workplace  
Requirements and Lobbying

Persons signing this form should refer to the regulations referenced below for complete instructions:

Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Covered Transactions - The prospective primary participant further agrees by submitting this proposal that it will include the clause titled, "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transaction," provided by the department or agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions. See below for language to be used: use this form for certification and sign: or use Department of the Interior Form 1954 (DI-1954). (See Appendix A of Subpart D of 43 CFR Part 12.)

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions - (See Appendix B of Subpart D of 43 CFR Part 12.)

Certification Regarding Drug-Free Workplace Requirements - Alternate I. (Grantees Other Than Individuals) and Alternate II. (Grantees Who are Individuals) - (See Appendix C of Subpart D of 43 CFR Part 12.)

Signature on this form provides for compliance with Certification requirements under 43 CFR Parts 12 and 18. The certifications shall be treated as a material representation of fact upon which reliance will be placed when the Department of the Interior determines to award the covered transaction, grant, cooperative agreement or loan.

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PART A: Certification Regarding Debarment, Suspension, and Other Responsibility Matters -  
Primary Covered Transactions

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~~CHECK~~ ☒ IF THIS CERTIFICATION IS FOR A PRIMARY COVERED TRANSACTION AND IS APPLICABLE.

- (1) The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:
- (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
  - (b) Have not within a three year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
  - (c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and
  - (d) Have not within a three year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.
- (2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.
- 

PART B Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion -  
**Lower** Tier Covered Transactions

---

CHECK — IF THIS CERTIFICATION IS FOR A LOWER TIER COVERED TRANSACTION AND IS APPLICABLE

- (1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.
- (2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

DI-2010  
March 1995  
(This form consolidates DI-1953, DI-1954,  
DI-1955, DI-1956 and DI-1963)

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**PARTC:** Certification Regarding Drug-Free Workplace Requirements

---

*CHECK ☒ IF THIS CERTIFICATION IS FOR AN APPLICANT WHO IS NOT AN INDIVIDUAL.*

Alternate I. (Grantees Other Than Individuals)

A. The grantee certifies that it ~~will~~ or continue to provide a drug-free workplace by:

- (a) ~~Publishing a statement~~ notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a ~~controlled substance is prohibited~~ in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition;
- (b) Establishing an ongoing drug-free awareness program to inform employees about--
  - (1) ~~the~~ dangers of drug abuse in the workplace;
  - (2) The grantee's policy of maintaining a drug-free workplace;
  - (3) Any available drug counseling, rehabilitation, and employee assistance programs; and
  - (4) ~~the~~ penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;
- (c) ~~Making it a requirement that each~~ employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (a);
- (d) ~~Notifying the employee in the statement~~ required by paragraph (a) that, as a condition of employment under the grant, the employee will --
  - (1) Abide by the terms of the statement; and
  - (2) ~~Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction;~~
- (e) ~~Notifying the agency in writing, within ten calendar days after receiving notice under subparagraph (d)(2) from an employee or otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice, including position title, to every grant officer on whose grant activity the convicted employee was working, unless the Federal agency has designated a central point for the receipt of such notices. Notice shall include the identification number(s) of each affected grant;~~
- (f) ~~Taking one of the following actions, within 30 calendar days of receiving notice under subparagraph (d)(2), with respect to any employee who is so convicted --~~
  - (1) ~~Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or~~
  - (2) ~~Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency;~~
- (g) ~~Making a good faith effort to continue~~ to maintain a drug-free workplace through implementation of paragraphs (a), (b), (c), (d), (e) and (f).

B. The grantee may insert in the space provided below the site(s) for the performance of work done in connection with the specific grant:

Place of Performance (Street address, city, county, state, zip code)

\_\_\_\_\_

Check ☐ if there are workplaces on file that are not identified here.

---

**PARTD:** Certification Regarding Drug-Free Workplace Requirements

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*CHECK ☐ IF THIS CERTIFICATION IS FOR AN APPLICANT WHO IS AN INDIVIDUAL.*

Alternate II. (Grantees Who Are Individuals)

- (a) The grantee certifies that, as a condition of the grant, he or she ~~will~~ not engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance in conducting any activity with the grant;
- (b) If convicted of a criminal drug offense resulting from a violation occurring during the conduct of any grant activity, he or she will report the conviction, in writing, within 10 calendar days of the conviction, to the grant officer or other designee, unless the Federal agency designates a central point for the receipt of such notices. When notice is made to such a central point, it shall include the identification number(s) of each affected grant.

01-2010  
March 1995  
(This form consolidates DI-1953, DI-1954,  
DI-1955, 01-1956 and DI-1963)

---

**PARTE:** Certification Regarding Lobbying  
Certification for Contracts, Grants, Loans, and Cooperative Agreements

---

CHECK ☐ IF CERTIFICATION IS FOR THE AWARD OF ANY OF THE FOLLOWING AND THE AMOUNT EXCEEDS \$100,000: A FEDERAL GRANTOR COOPERATIVE AGREEMENT, SUBCONTRACT, OR SUBGRANT UNDER THE GRANTOR COOPERATIVE AGREEMENT.

CHECK ☐ IF CERTIFICATION IS FOR THE AWARD OF A FEDERAL LOAN EXCEEDING THE AMOUNT OF \$150,000, OR A SUBGRANTOR SUBCONTRACT EXCEEDING \$100,000, UNDER THE LOAN.

The undersigned certifies, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, and officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

As the authorized certifying official, I hereby certify that the above specified certifications are true.

SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL David Garcia  
for Patricia A. Gates  
TYPED NAME AND TITLE Sr. Research Administrator  
DATE 6/2/00

DI-2010

March 1995

[This form consolidates DI-1953, DI-1954,

DI-1955, DI-1956 and DI-1963)